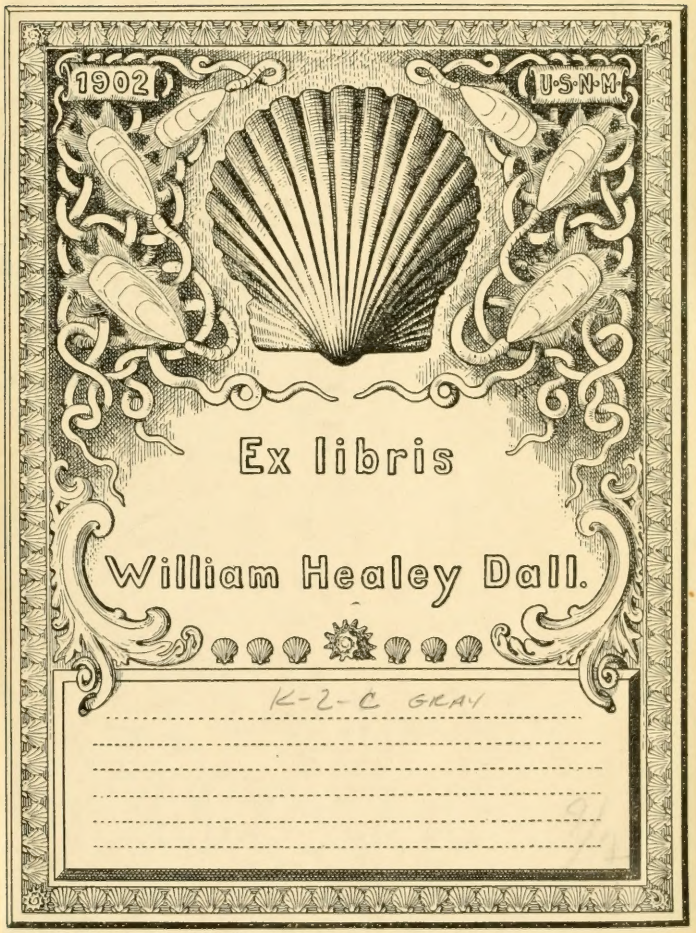
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THE

# LAND AND FRESH-WATER SHELLS

OF

# THE BRITISH ISLANDS.

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# MANUAL

OF THE

# LAND AND FRESH-WATER SHELLS

OF

## THE BRITISH ISLANDS.

WITH FIGURES OF EACH OF THE KINDS.

BY

WILLIAM TURTON, M.D.

NEW EDITION, WITH ADDITIONS,

BY

JOHN EDWARD GRAY, PH.D., F.R.S.

F.L.S., F.R.G.S., V.P.Z.S. & ENT. SOC., ETC.

LONDON:

LONGMAN, BROWN, GREEN, LONGMANS, AND ROBERTS.

1857.

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"Nothing can be unworthy of being investigated by man, which was thought worthy of being created by God." BOYLE.

"Divine communications are alike vouchsafed to us by the Volume of Nature and the pages of inspiration." BACON.

"Deum *sempiternum*, *omniscium*, *omnipotentem* a tergo transeuntem vidi et obstupui! Legi aliquot ejus *vestigia* per creata rerum, in quibus omnibus *etiam minimis ut fere nullis* quæ vis! quanta sapientia! quam inextricabilis perfectio!" LINN. *Syst. Nat.* p. 8.

TO

MARIA EMMA,

MY HELPMATE IN ALL MY STUDIES AND ALL MY CARES,

THIS LITTLE WORK IS

Dedicated

BY

HER AFFECTIONATE HUSBAND,

JOHN EDWARD GRAY.

# PREFACE.

THE great attention paid to the British land and fresh-water shells by Montagu; by my late friend and teacher in zoology, Dr. Leach; and more recently by Mr. Jeffreys, Mr. Jenyns, and Mr. Alder (more especially the latter), has left me little else to do, in revising this edition, than to embody their observations. This is the more peculiarly the case, inasmuch as they all, in a great measure, worked from the collection now under my charge, which contains the materials used by Dr. Leach in preparing his work on British Mollusca, and, among the rest, the various specimens which I had myself collected when actively engaged in the study of our British species. It is right, however, to add, that, before adopting the remarks of these authors, I have, in every instance where it was in my power (and that was almost universally), verified the facts myself; and therefore, although I have used their words from a desire to do justice to their labours, the conclusions are most frequently equally my own.

The description of the species is preceded by a general outline of the distribution of molluscous animals; and the genera have been distributed into natural families from characters taken from the consideration of the animal, which alone can be regarded as the proper subject for classification. Every day proves, to the scientific conchologist, that every modification in the structure of the animal impresses its character on the shell, and that the shells thus afford good subsidiary characters for the distinction of groups.

In the observations appended to the characters of groups and species, there is added, as opportunities occurred, a physiological account of the mode of formation and structure of the different parts of shells.* It is to this part of the subject that I would especially direct the attention of my readers; as, in the study of the structure, formation, development, and colouring of the shells, and in the habits of the animals which form them, they will find a never-failing source of pleasure and instruction, which can be carried on without any expense. For these particulars are as easily to be observed in the most common snail, as in the finest and most expensive shells in the cabinets of

* For a larger exposition of my views on this subject, reference should be made to my papers published in the first volume of the *Zoological Journal*, and in the *Philosophical Transactions* for 1833; the latter paper is reprinted in Dr. George Johnston's *Introduction to Conchology*.

the curious; and the details are more easily followed out, from the very fact of the facility of observing many specimens at the same time, in different states of development: so that, to the philosophical conchologist and reflecting student, the most common specimens may do more to illustrate the perfection and all-seeing wisdom of the Creator, than the most costly collection. In the description of the species, particular attention has been paid to dividing them into small groups, to facilitate their determination; and an attempt has been made to point out the different varieties that occur, not by describing each individual variety that may be found, but by indicating the points that have been observed to be most liable to variation, and also the monstrosities which, from the mode of formation of the shell, and some peculiarities in the habit of the different species, are likely to take place in each of them. To illustrate the animals of the different families and genera, a series of vignettes has been given; and further to assist in determining the species, some wood-cut figures of different parts of the animal, as the jaws, teeth, operculum, &c. &c., and of the shells, have been interspersed in the text.

All the new species introduced into the work, and the more remarkable varieties, have been figured, and added to the plates (except *Vertigo angustior*, which could not be procured); and the whole of the figures which were given in the former edition have

been compared with the specimens, and corrected where required. There have also been added to these plates other figures of the same species, and enlarged details of those parts of the smaller kinds which are calculated to facilitate the determination of the species; a short description of the animals, and a few notes on their habits, have also been added; and this new feature in the work might have been greatly extended, had it not been feared to add too much to its bulk. Indeed, although this work has been called in the titlepage a new edition of Dr. Turton's Manual, it may be almost considered a new publication, as the only portions of the former edition that have been retained are the descriptions of the species, and a few of the general observations; insomuch that, on revising it in its printed form, it is a matter of regret to me, that it was not rather undertaken as an entirely new work, which would not have cost me nearly so much trouble as editing the present one.

As an Appendix, there have been added, for the purpose of assisting the young student, or those who study the mere shells, without paying any attention to the animals that form them, an artificial table of the genera; an outline of the history of the various additions that have been made, from time to time, in this part of our Fauna; a list of the species which I have reason to believe had been, from various causes, erroneously introduced into works of this

kind, with the grounds on which they have been here rejected; and, lastly, a catalogue of the works and papers which treat on British land and fresh-water mollusca, and of the best works on European and North American species.

JOHN EDWARD GRAY.

British Museum,
Sept., 1857.

"What is the character of the Being who has thus multiplied existences, created life in multitudes beyond the mind of man to conceive, to fill every point of the globe, to enjoy, and to be perpetuated, that life may be for ever enjoyed? He was not compelled. Did He intend good, when he gave to them all their several capacities and powers; desires, and the means of gratifying them, as various as their forms? Is He who feeds these incalculable myriads — as he has fed them from the beginning — a beneficent Father? Is there one among ourselves who does this for twenty — for ten? He is a mark for the praise and the love of men. We are overwhelmed with awe in viewing the power of God in the great orbs of the universe: but to Him an insect or a plant is a work of equal effort; and can the number of these orbs exceed those of the animals in the universe? They do not equal them by myriads on myriads, if all are thus inhabited, as we must believe. We see His wisdom and His government everywhere; but where is it more fully displayed than in the feeding of these multitudes; in the preservation of order, peace, and harmony; in ruling the desires and the wills which He has given; in making this vast intricate political system work as man cannot make his own do for a few thousands? Can Omniscience be more extended and divided than it is here, among these endless beings, of which there is not one that He does not know; since to every one He imparted its life, its body, and its mind? All this I see. I behold him in the living world as I see Him nowhere else; for here it is that I see what I cannot discover elsewhere — the speaking demonstration of His beneficence." — Mac Culloch, *Attributes of God*, iii. 86.

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# A MANUAL

OF THE

# LAND AND FRESH-WATER MOLLUSCA

OF

# THE BRITISH ISLANDS.

---

Mollusca is the name given to that large division of the animal kingdom which is characterised by having a soft fleshy body, destitute both of a bony skeleton supporting jointed limbs, and of a hard ringed skin.

They are covered with a muscular coat, called a *mantle*, endued with a glairy humour, and are generally furnished with a calcareous envelope called a *shell*, which is secreted by this coat for the protection of the body or of the more vital organs of the animal.

They are usually elongate, walking on a single central foot or disk, and are furnished with one or more pairs of organs on the head and sides. Their nervous system, which affords the most distinctive character of the larger groups of the animal kingdom, merely consists of a certain number of medul

lary masses distributed to different parts of the body; one of the masses being placed over the gullet, and enveloping it like a collar.

Linnæus refers all the animals inhabiting shells to five different genera; viz., *Limax*, *Ascidia*, *Anomia*, *Clio*, and *Sepia*. These genera may be regarded as the types of the classes proposed by Cuvier. Poli had, before his time, considered three of them as orders, under the names of *Mollusca Reptantia*, *Subsilentia*, and *Brachiata*.

This division of the animal kingdom is subdivided into five classes in the following manner: —

A. *Crawling on a foot placed under the body.* — Pedifera.

I. Gasteropoda, *Gasteropods*, or *Univalves*, which have a distinct head, furnished with eyes and tentacles, and are usually protected by a conical more or less spiral shell, often furnished with an operculum.

II. Conchifera, *Conchifers*, or *Bivalves*. — Having the mouth placed between the gills, they and the body enclosed between the two leaves of the mantle, which are covered with two shelly valves united above by a ligament.

B. *Destitute of any foot.* — Apoda.

III. Brachiopoda, *Brachiopods*, or *Lamp Shells*. — Having the mouth placed at the base of two spirally twisted ciliated arms, between the two leaves of the mantle, which are co-

vered with two separate shelly valves: they live attached to other marine bodies.

IV. PTEROPODA or *Pteropods*, having a prominent head, with one or two pairs of fins on the sides of the neck, by means of which they swim about on the ocean; body is often covered with a thin glassy conoidal shell.

V. CEPHALOPODA or *Cephalopods*, which have a large distinct head, furnished with eight or ten arms, by means of which they walk head downwards.

The terrestrial and fluviatile Mollusca, of which alone we have to treat in this little work, are confined to the two first of these classes.

The SHELL, which is peculiar to this division of the animal kingdom, may be seen covering the young animal in the egg, before it has gained all its organs, as was observed by Swammerdam, and verified by the more extended observations of Pfeiffer, Turpin, and others. This may easily be seen in the egg of the *Limnæi*, *Physæ*, *Ancyli*, and *Bithiniæ*, which have a transparent coat.

The shells of the newly-hatched animals have been frequently considered as distinct species; and some very thin shells of land Mollusca, such as *Vitrinæ*, have been taken for the young of other well-known species, as *H. hortensis*. These young shells are easily known by their always being of a pale horn colour; the whorls are generally rather irregular, and enlarge very rapidly; and the apex of the whorl which was first formed is generally large

and blunt, compared with the size of the shell. They are always destitute of colour, for the animal does not deposit the colouring matter until after it has been hatched; and it is therefore generally easy to distinguish in the young shell (and sometimes also in the adult) that part of the top of the spire which formed the shell of the animal when in the egg.

The shell is formed by the hardening of the animal matter, which is secreted by certain glands on the surface of the body, by means of chalky matter, also secreted by similar glands. It has been stated that the unhatched animal, very shortly after it is formed, begins to make its shell; and when it is hatched, deposits on the edge of the mouth of the little shell which covered its body in the egg, a small quantity of the mucous secretion. This dries, and is then lined with some mucous matter, intermixed with calcareous particles; and when this hardens, it again places on its edge another very thin layer of the mucous secretion, and again lines it as before. The mucous secretion first deposited forms the outer coat of the shell, which is called the *periostraca* or *epidermis*, some persons having regarded it as similar to the epidermis of the human skin. It is of use in protecting it from injury; while the mucous matter mixed with lime, which is placed within it, forms the substance of the shell itself, and constitutes, with the calcareous matter already existing, the crystalline structure of the shell. This deposition of mucus, and of mucus mixed with calcareous matter, goes on as the animal grows and feels the want of a larger shell for its protection: the shell is,

in fact, moulded on the body of the animal itself, as the body grows; and for this reason any inequality in the body is moulded in the shell.

The animal has the faculty, also, of mending any break or injury that its shell may have received, if it is not of such a magnitude as to derange all the functions of the animal itself; and it mends them in the same manner as it forms its shell, that is to say, by depositing first a coat of animal matter, and then lining it with mucous matter, mixed with chalk to harden it. But as the animal is usually very desirous of getting the repairs done as quickly as possible, and is most probably damaged by the injury it has received, these repairs are generally much more roughly executed than the shell itself, and commonly destitute of regular colour.

The particles which vary the colour of the surface of the shell are deposited, while the shell is being increased in size, immediately under the outer mucous coat; and as these particles are also secreted by peculiar glands, the colour is always situated in a particular manner on each species, the glands being gradually enlarged, and gradually separated, but not changed in position, by the growth of the animal. All the variations exhibited in the colouring of the different species, or in the different individuals of the same species, are produced by the permanent or temporary interruption of the action of these glands. But for a more detailed account of these phenomena, I must refer the reader to my papers on the subject in the *Philosophical Transactions* for 1833, reprinted in Dr. Johnston's *Letters on Conchology*.

In describing shells, they should be regarded in their natural position; that is to say, in the way in which they are placed on the animal. Thus the part of the shell over the head of the animal is called the front, and that over the tail the back, of the shell; and the left and right sides of the shell correspond with the left and right sides of the animal.

This is exceedingly easy to be determined in the univalve shells, because the apex of the shelly cone, whether it be simply conical or spiral, in all univalves (except *Patella* and *Lottia*) is over the hinder part of the animal; therefore, if a shell is placed on its mouth, with the apex towards the spectator, the parts of the shell will correspond with the position of the person who is looking at it.

As all shells are formed of a shelly cone (which, when very long, is generally rolled round an imaginary axis, for the purpose of diminishing the space that it occupies; but when it is short, is sometimes only slightly recurved, as in the *Ancylus* and *Velletia*), in order to maintain a similarity of terms for the same thing in these two forms, all the lines or grooves which pass from the apex of the cone to the mouth, and which are caused by some permanent modifications of the edge of the mantle, are called longitudinal or spiral, and all the lines which are paralled to the edge of the mouth of the shell, and which, in fact, are generally marks of its growth, or are caused by some periodical development of the margin of the mantle, are designated as concentric or transverse. Thus the striæ on the *Cyclostoma elegans* and *Planorbis albus* are longitudinal or spiral,

and the *lamellæ* on *Helix lamellata* and *H. aculeata* are concentric or transverse.

But when we speak of the spiral shell as a whole, it is usual to call it short, or elongate, according to the length of the imaginary axis on which the whorls are rolled; and when we speak of the length of the mouth, it extends from the line which forms the front, to the hinder edge of the mouth, which, in the *Ancylus*, occupies the whole length of the shell: the breadth is the line which crosses this at a right angle.

From the manner of formation, most spiral shells are liable to four kinds of distortion:—

1. The vertical elevation of the spire is more than normally depressed; the shells are called *subdiscoidal* or *depressed.*

2. The vertical elevation of the spire is more than usually elevated. When the whorls of these are continuous, these are called *trochoid* or *subscalariform*, and when they are separated from each other *scalariform;* and when quite unrolled like a corkscrew, it is called *ceratoid* or *cornucopia-shaped.*

3. The whorls are irregularly twisted; this is most common in the genus *Planorbis.*

4. When the whorls are rolled in a contrary direction to that of the usual or normal direction of the shell, they are said to be reversed; when the mouth is on the left hand of the axis, they are *sinistral;* to the right, *dextral.*

It is equally easy to determine the natural position of the bivalves without the presence of the animal; for the ligament is always placed on the dorsal surface of the animal, and the mouth is placed on that side of the apex of the valve, or *umbo*, which is before the ligament. Consequently, if a bivalve shell is placed on the table, with its hinge-side uppermost, and with the ligament towards the observer, the shell will be in its natural situation, and the sides of the shell will agree with the sides of the observer.

It is to be remarked that Linnæus, and the naturalists of his school, described what is here called the front of the shell as the back, the left valve as the right, and *vice versâ;* and Lamarck in general (but not universally) followed the same rule. The method above described is, however, so obviously correct, and every other so liable to confusion from the want of a sound foundation, that it cannot fail, sooner or later, to be universally adopted.

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## Class I. GASTEROPODA.

The adult animal furnished with a more or less distinct foot, placed under the body, for crawling on the ground or the surface of the water. Having a distinct head furnished with eyes and tentacles, they are usually protected by one or by two unequal-sized valves, the largest being conical, spiral, and enclosing the greater part of the body, and the smaller forming

a kind of lid or operculum to the aperture of the other valve.

Sub-class I. *Gill comblike, formed of one or two series of lamellæ, under the mantle on the back of the neck, or rarely round its edge, in an open gill cavity. Adult and larva shell-bearing; larva furnished with deciduous cephalic fins. Unisexual or hermaphrodite, and self-impregnating:* Ctenobranchiata.

Order I. PECTINIBRANCHIATA.—Gills comblike, formed of one (or rarely two) longitudinal series of laminæ, or rarely of branched vessels, on the left side of the back of the mantle over the back of the neck. Animal unisexual; shell spiral.

Order II. SCUTIBRANCHIATA.—Gills consisting of two series of lamellæ, forming one or two series over the back of the neck, or under the edge of the mantle round the foot. Animal hermaphrodite, self-impregnating; shell conical, spiral, or symmetrical; rectum often traversing the heart.

Sub-class II. *Respiratory organs variously formed, gills exposed, or only slightly covered by a fold of the mantle, or in the form of a closed lunglike cavity. Hermaphrodite, with reciprocal impregnation:* Heterobranchiata.

Order III. PLEUROBRANCHIATA.—Gills forming a tuft on the sides under a fold of the mantle.

Shell spiral; adult and larva shell-bearing; larva with deciduous cephalic fins.

Order IV. Gymnobranchiata.—Gills exposed, or contractile into a cavity on the surface of the mantle. Adult shell-less; larva shell-bearing, with deciduous cephalic fins.

Order V. Pneumobranchiata.—Respiring free air in a closed chamber lined with pulmonic vessels. Adult and larva shell-bearing; larva shaped like the parent, without cephalic fins.

The last order consists almost entirely of terrestrial or fluviatile Mollusca, their organisation being only adapted for respiring free air; and there are a few fluviatile species found in the first and second order: the rest are all marine, and therefore excluded from our consideration at present.

The *operculum* of Gasteropodous Mollusca is like the shelly valve of those animals; and the shelly valve and the operculum together are homologous to the two valves of a conchiferous mollusk. I am therefore led to believe that the normal or typical form of mollusca is, to be protected by two valves or shells. If this theory be correct, the operculum should afford an important character for the distinction of families and genera.

As this theory is not generally understood, I may add that the operculum of these gasteropodous mollusca, like the shelly valve of those animals and of each of the valves of bivalves, —

1. Is developed on the embryo long before it is hatched.

2. That it is placed on and covers a peculiar part of the body, which bears the same relation to it as the part of the body called the mantle, bears to the part usually called the shell of these animals; and it is formed, and increases in size, by an opercular mantle in the same way as the shells are.

3. That the operculum is more or less conical, and is increased in size by the addition of new matter to the inner surface, and especially to the part of it near the margin, the new matter either forming more or less complete rings round the nucleus (or first-formed part)—when it is called *annular*, and is homologous to the simply conical shells, as the *Patella;* or the new matter is deposited almost entirely on one edge of the nucleus, when the operculum forms a more or less elongated cone, which when long is generally twisted round an imaginary axis (like a spiral shell), the broad part of the cone being next the edge of the opercular mantle which generates the new matter for enlarging its size, as the mouth of the shell is on the outer edge of the mantle of the univalve shell.

4. That the operculum is attached to the animal by means of one or more muscles which, as in inequivalved bivalved shells, pass from the larger valve, or shell, to the smaller one, or operculum.

5. The operculum as it increases in size is gradually moved on the end of the muscle; the many-whorled opercula of the *trochi* revolve as many times on the end of the muscle as the many-whorled

spiral shell turns on its imaginary axis, causing the muscles to move down the inner surface of the aperture.

6. The operculum is moulded on the opercular mantle, and is often lined internally with a shelly coat; and sometimes, as in certain shells, it has its outer surface covered with calcareous matter, deposited by some special development of the opercular mantle destined for the purpose, as is the case with the cowries and some other shells.

From these observations it appears that the operculum has all the characters of the appendage of the animal which has been usually considered as the shell of univalves, and the valves of bivalves.

7. That as the valves of bivalves are always twisted in opposite directions, so that each bivalve shell is composed of a dextral and sinistral valve united together by a ligament, so the operculum of a shell is always turned in the contrary direction to that of the shelly valve of the animal to which it belongs, the dextral shell having a sinistral operculum, and *vice versâ*. Thus the position of the nucleus of the annular operculum, or the spire of the spiral operculum, is always twisted in an opposite direction from that of the shell to which it belongs, as is the case with the two valves of a conchiferous animal. This is easily observed by comparing the position of the nucleus of the dextral and sinistral genera of Ampullaridæ, or the spiral operculum of a sinistral malformation of a gasteropod, with that of one of the normal form. I may observe that, as is the case with spiral shells, when the shell is turned

in an abnormal direction, the direction of the operculum is also changed.

9. The opercula are repaired, when injured or partly broken off, in the same manner and by the same means, and when repaired offer the same external appearance, which shells do under similar circumstances. See *Ann. and Mag. N. H.* 1850, v. 476.; and 1854, xiii. 419.

The principal difference between the operculum and the valves or shells of the gasteropod consists —

1. In the operculum having no cavity. The cone of which it is formed is either very much depressed, so as to be nearly flat or even concave, as in the annular or subannular operculum, or very much compressed, forming only a spiral band, as in the spiral operculum. The absence of a cavity is a difference only of degree, for the valves of some gasteropods (as *Umbrella*, for instance) are so flat as to produce no cavity, and thus greatly resemble the annular operculum of *Ampullaria*, and the flat valves of some *Calytræ* are like the subspiral operculum of *Littorina*, but the greatest resemblance is to be observed in the small flat valves of some *Gryphæa*, *Exogyra*, *Chama*, and other genera of bivalve shells, which are attached by one of their valves. These valves are often quite as flat and destitute of any cavity as the operculum of any gasteropod; and it is to be remarked that these valves exactly resemble a spiral operculum in shape, the remains of the ligament forming a spiral mark on the outer surface, showing how the valve has rotated on the body of

the animal, as the operculum rotates on the foot of the gasteropods.

2. The operculum of by far the greater number of gasteropods is only formed of animal matter, so that the operculum appears to consist entirely of what constitutes the periostraca or *drap marin* of the shelly valves; but the shells of some gasteropods, as that of *Aplysia*, *Bulla*, of some land mollusks, and the valves of some bivalves, as *Lingula*, have only a very thin shelly internal layer, strengthening the thick periostraca; while many opercula, like the generality of shells, have a shelly coat deposited on the inner side of the horny periostracal coat, and others have both the inner and outer surface of the animal or periostracal part, covered with a shelly coat like the lining.

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## Order I. *PECTINIBRANCHIATA.*

Gills comb-like, formed of one, or rarely two longitudinal series of lamellæ, or very rarely some branched vessels, on the left side of the mantle, over the back of the neck; the gill cavity is open, the mantle edge being free for the back of the neck. Animal unisexual; shell spiral; operculum usually well developed, rarely absent.

This order is divided into three sub-orders, thus:—

I. Toxifera. — Head small; proboscis retractile, under the base of the tentacles; teeth elon-

gate, subulate, implanted in the fleshy proboscis. Carnivorous, venomous, marine.

II. PROBOSCIDIFERA. — Head small; proboscis retractile under the base of the tentacles; teeth variable, in three, five, or one longitudinal series, on an elongated cartilaginous tongue membrane. Carnivorous, marine.

III. ROSTRIFERA. — Head produced into a rostrum, with the tentacles on the side of its base; teeth in seven longitudinal series, on a cartilaginous tongue membrane. Phytophagous, marine, fluviatile, and terrestrial.

The two first sub-orders are confined to marine animals; the last contains a few fluviatile or terrestrial species.

### Sub-order III. *ROSTRIFERA.*

Head moderate, with a more or less elongated, produced, contractile, transversely-annulated rostrum; tentacles subulate, far apart, on the sides of the base of the rostrum; eyes on the outer side, or behind the base of the tentacles; teeth on an elongated linear lingual membrane partially received in the visceral cavity, in seven longitudinal series; the central and inner lateral teeth fixed, with a broad base; the two outer lateral teeth versatile, suberect, the upper edge lobed. Phytophagous, marine, fluviatile, and terrestrial.

This group is divided into sections, according to the form of the foot, which is modified by the

habits of the animals: — 1. *Platypoda.* The foot depressed, expanded for crawling. 2. *Protopoda.* Foot roundish, truncate, or clavate when the animals are sedentary, living in shells attached to marine bodies. 3. *Leptopoda.* Foot compressed for leaping. 4. *Heteropoda.* The foot compressed, fin-like, with a small sucker for attaching itself to floating bodies.

The British fluviatile and terrestrial species all belong to the first section, and form a division of it, characterised by having the eyes sessile, or nearly so, on the outer side of the bases of the subulate tentacles, and the mantle enclosed in the shell, which have been called *Edriophthalma*, *Cochlea.*

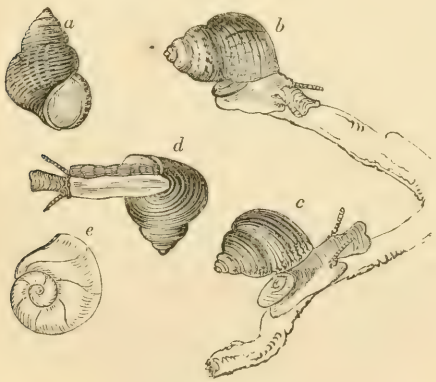
These animals are divided into groups or families, according to the formation of the respiratory organs or *gills*, and position of the eyes, thus:—

1. *Cyclostomidæ.* Eyes lateral, external; gills vascular.
2. *Littorinidæ.* Eyes lateral, external; gills laminal; operculum spiral.
3. *Bithiniadæ.* Eyes lateral, external; gills laminar; operculum annular.
4. *Viviparidæ.* Eyes lateral, external; gills *filamentous;* operculum annular.
5. *Valvatidæ.* Eyes lateral, external; gills subpinnate, exposed; operculum spiral.
6. *Aciculidæ.* Eyes at the internal base of the tentacles; operculum spiral.

## Fam. 1. CYCLOSTOMIDÆ.

The gills are vascular, branched, lining the inside of the mantle, the outer edge of which is free from the back of the neck; the eyes are sessile, on the outer side of the base of the tentacles; male organs hidden in the hinder part of the cavity under the edge of the mantle. Mantle with a thin edge. Jaw none; vent on the right side of the edge of the mantle. Foot broad, body central spiral, enveloped in a simple edged mantle, which is covered with an ovate spiral shell, with a roundish mouth, and furnished with a spiral operculum.

*Fig.* 1.




*Cyclostoma elegans.*

*d*, showing the under side of the foot, divided into two parts.
*e*, operculum.

These animals live on vegetable matter, like the snails, and are found in damp places on a chalky soil.

The *Cyclostomidæ* differ from the true *Pneumonobranchiata*, with which they have been generally previously confounded, in the *mantle* being free from the back of the neck, leaving the pulmonary cavity open, and in the animals being unisexual and provided with a distinct well-developed spiral operculum.

M. Moquin Tandon observes that in the front of the pulmonary cavity of *Cyclostoma elegans*, near the collar, the pulmonary vessels are closer together, producing some parallel slightly flexuous ridges, which appear to be rudimentary gills. (See pp. 74. 166.)

These animals, when they walk, apply their proboscis to the ground to assist them in progression.

### 1. Cyclostoma. (Circle Shell.)

Shell ovate-spiral; mouth simple, united all round; operculum of a few flat whorls, with a simple shelly internal coat; the foot divided into two parts by a longitudinal central groove. (See fig. 4. p. 17. Operculum rather ovate, double-edged, internally concamerated, with transverse concentric and septa. Shelly whorls 4 or 5, gradually increasing. Nucleus excentric.

The foot is formed of two longitudinal portions: as the animal walks, the portion on one side is first advanced, while the animal holds on by the other; and then holds on with the advanced portion as the other side is gradually advanced before it. (See p. 17. f. 4. *Rossmässler, Icon.* i. 89. t. 2. f. 80. 82.)

This is the case with *Cyclostoma lineolata* and the

exotic species with ovate, few-whorled opercula. The foot of the species with orbicular, horny, many-whorled opercula is not so divided, but broad and expanded, like the foot of other terrestrial Mollusca.

Dr. Turton, in his descriptions of this genus (ed. 1. 93.), says the shell has no epidermis; but this is a mistake: indeed, I am not aware of any shell that is really destitute of this important covering (see *Phil. Trans.* 1833), though it varies greatly in thickness in different genera, and in this genus it is very thin; but in some Indian species of the family it is thick, and forms a decided brown coat. In the same manner, he describes the operculum as horny. It is, as in most of the European species to which I am inclined to restrict the genus, decidedly shelly.

The generic name is from the circular circumference of the aperture or mouth.

1. 1. CYCLOSTOMA *elegans*. Elegant Circle Shell. — Shell conic-oval, with raised spiral striæ, and the peritreme attached at its upper part. (t. 7. f. 75.)

Cyclostoma elegans. *Drap.* p. 32. t. 1. f. 5. 8.; *Brard*, p. 103. t. 3. f. 7. 8.; *Linn. Trans.* xvi. f. 63.; *Turton, Man.* ed. 1. 93, f. 75.; *Leach, Syn. Moll.* 203.; *Forbes and Hanley, B. M.*, iv. 201. t. 122. f. 3. — Cyclostoma (Ericia) elegans. *Moq. Tand., Moll. Franc.* ii. 496. t. 37. f. 2. 23. — Junior Cycl. Saputus. *Maduyt, Moll. Vien.* 79. — Cyclostomus elegans. *De Montfort*, ii. p. 287. — Turbo elegans. *Mont.* p. 342. t. 22. f. 7.; *Linn. Trans.* viii. 167. — Turbo striatus. *Da Costa*, p. 86. t. 5. f. 9. — Turbo tumidus. *Penn. B. Zool.* 128. t. 82. f. 110. — Nerita elegans. *Müller, Verm.* ii. 177. — Var. Smaller, and nearly Smooth. — Cyclostoma marmorea. *Brown, Edinb. Journ. Nat. and Geog. Sci.*, 13. t. 1. f. 10. 11.

In hedges and under stones, in chalk and lime-

stone districts; England and Wales (*Lister*), β Scotland, Edinburgh.

Animal grey-brown.

Shell half an inch long, and four-tenths of an inch wide, solid, grey or purplish-yellow, mostly purple at the tip, often marked with two rows of purplish brown spots; spire composed of five rounded volutions, marked with numerous close-set raised spiral striæ and finer longitudinal ones between them; aperture round with a smalt angle at top, and an umbilicus behind the pillar; operculum hard, horny externally, and marked with a single depressed spiral line, from which some very fine striæ radiate towards the circumference.

Lister (*Tab. Anat.* iv. f. 1. 2. 3.) gives some account of the anatomy; and a very detailed description has lately been published by the Rev. Mr. Berkeley (*Zool. Journ.* iv. 278.).

The tips of the tentacles have a bright brown spot very visible to the naked eye, which Montague considered as a second eye. It is the organ of smell. The tentacles, in repose, are annulated, resting on the sides of the trunk.

Brard describes two unequally compressed cartilaginous pieces, one on each side of the buccal cavity. They are rounded on one side, thin and sinuous on the other; slightly tubercular and whitish.

## Fam. 2. LITTORINIDÆ.

Trunk produced and wrinkled, not retractile; tentacles far apart, on the side of the head; eyes

sessile, on the outer side of the base of the tentacles; jaws horny; teeth in 7 longitudinal series, converging. Mantle-edge simple. Gill single, formed of very numerous flat free cross-folds, occupying nearly the whole of the inner surface of the cavity. Foot moderately broad for walking. Opercular lobe simple. Operculum spiral, horny, of gradually enlarging whorls. Amphibious; marine, or in brackish water.

1. ASSIMINIA *Leach MS.* (Assiminia.)

Shell ovate, conical, solid; mouth ovate; tentacles simple, very short, scarcely longer than the tubercles on which the eyes are placed, and united to their side; operculum horny, ovate, of a few rapidly enlarging whorls. (p. 23. f. 3.)

The animal differs from *Littorina* in the apparent position of the eyes, which is an anomaly among the water or Ptenobranchous Mollusca.

This animal was first indicated, and its peculiarities pointed out, in my paper above quoted, in 1821 when I made the following remarks on its structure. "The animal of this shell differs from all others of the order (to which it belongs), by the eyes appearing to be placed at the end of the tentacle; but I believe that they are placed on a peduncle as long as the tentacle, and the peduncles and tentacula are soldered together."

Mr. Berkeley, in his description of the animal (*Zool. Journ.* v. 429.), observes,—"The most remarkable circumstance in this animal is the position

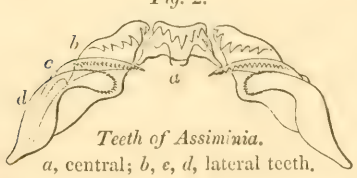
of the eyes at the tip of the tentacle, as in *Helix* and its allies, and not at the base. It would appear as if there were in reality no tentacula, and only the tubercle, common to many Mollusca, at the base of the tentacula, a little more developed than usual." I am inclined to retain my former theory; for if the pedicle of the eye of this genus is minutely examined, it will appear to be formed of two parts united by a suture.

There has been a great controversy about this genus. Consult *Ann. and Mag. Nat. Hist.* 1855, xvi. pp. 114. 184. 272. and 422.; 1836, xvii. 49. 56.

A shell which I described from India, under the name of *Turbo Francesia* (Wood, Supp. t. 6. f. 28.), has been found by Mr. Benson to have the same kind of animal, and to be a second species of the genus.

The central tooth is wider below, the base truncated in the middle, prominent on both sides; produced into a horn, cutting edge triangular, with five or seven pointed lobes. The first lateral tooth with seven lobes, the third lobe larger; the second slender, upper part claw-like, serrated on the outside; the third tooth rounded at the tip, ciliate, denticulate (fig. 2.).

*Fig.* 2.




*Teeth of Assiminia.*
*a*, central; *b*, *c*, *d*, lateral teeth.

2. 1. Assiminia *Grayana*. Liver-coloured Assiminia. — Shell ovate, acute, solid, liver-brown; suture slightly impressed; mouth ovate. (f. 127.)

Nerita Syncera hepatica. *Gray, Med. Repos.* 1821, p. 239. — Assiminia Grayana, *Leach, MS.* 1816; *Flem. B. A.* 275.; *Berkeley, Zool. Journ.* v. 429. t. 19. f. 4.; *Leach, Syn. Moll.* 155. t. 9. f. 4. 5.; *Gray, Ann. and Mag. N. H.* xvi. 183. 422, xviii. 49.; *Forbes and Hanley, B. M.* iii. 70. t. 71. f. 3, 4. t. *H. H.* f. 6.; *Clark, Ann. and Mag. N. H.*, xvi. 114. 272. 1855, xvii. 57. 1856. — Lymneus Grayanus. *Jeffreys, Linn. Trans.* xvi. 378. — Paludina Grayana. *Potiez and Mich., Gal.* i. 251. t. 25. f. 23, 24.

Inhab. the mouths of rivers, and small streams connected with them, seldom out of the reach of brackish water.

Foot broadly obovate, obtuse, compressed, evidently of two distinct laminæ, the lower projecting beyond the upper, and separated from it by an accurately defined line; above fuscous, beneath olivaceous, shaded with cinereous; tentacles very short and obtuse, fuscous, eyes at their tips; muzzle porrect, not truly proboscidiform, deeply notched in front, fuscous, strongly annulated; the edge of the lips paler: on each side is a groove running backwards from the base of the tentacula.

*Fig.* 3.

*Assiminia.*
*a* and *c*, head.

Shell about $\frac{1}{4}$ inch long, ovate, solid, bright, shining, liver-brown, with a conical spire, and slightly impressed suture. The axis is imperforated. Operculum horny, ovate, black-brown.

Very like the small *Littorinæ*, but more solid, and differs in the animal; it is curious that so abundant a shell should have been overlooked by Montagu and his correspondents.

There may be noticed two marine species, sometimes found with the former.

1. LITTORINA *anatina.*

Paludina anatina. *Drap., Michaud, Alder, Mag. Zool. and Bot.* ii. 116. — Bithynia inflata. *Leach, Syn. Moll.* 210.

Sometimes found in the marshes at Greenwich, with the *Assiminia Grayana.* The shell is ovate, perforated, thin, transparent; the whorls are ventricose, rounded, and the mouth ovate; the operculum is horny, brown. It is like *Bithinia ventricosa,* but smaller and shorter, and has a horny spiral operculum, like the periwinkle; the peristome is continued; the shell is often covered with green *Algæ.*

2. LITTORINA *muriatica,*

Turbo muriaticus, *Linn.* — Cyclostoma acutum, *Drap.*

which has been placed by the latter author as a fresh-water species, is abundant on many parts of our coasts. It is nearly allied to *Littorina ulvæ.* Hartmann has formed a genus called *Hydrobia* from these small Littorinæ.

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## Fam. 3. BITHINIADÆ.

Head annulated, contractile, narrow, and not extending to the plane of the foot. Teeth in 7 longitudinal series, the lateral converging. (*Moquin*, t. 39. f. 26. 28.) Jaws none. Tentacles subulate, equal. Eyes sessile, on the outside of the base of the tentacles. Mantle simple in front; neck with small veil on the right side. Gills single, in the form of a transverse parallel, flexuous plaits attached to the

inner surface of the respiratory cavity; the ridges narrow, slightly dilated, and angulated near the middle. (*Moquin Tandon*, t. 39. f. 31. 32.) Stomach with cartilaginous stylets. Male organs at the hinder base of the right tentacle, always exposed, filiform, bifid. (*Moquin Tandon*, t. 39. f. 37.) Shell spiral; mouth oval, entire; peristome thickened. Operculum annular, with an internal shelly coat; crabby claws, not withdrawn in the aperture of the shell. Oviparous, eggs in oblong masses.

### 1. Bithinia *Gray*. (Bithinia.)

Operculum filling the mouth of the shell, lined internally with a thick shelly coat; nucleus subcentral (f. 4. c.); the mouth of the shell ovate, continued, rather angular behind, with a slightly thickened internal rib.

*Fig.* 4.

*Bithinia ventricosa.*
*c*, operculum.

These animals are oviparous, their eggs being deposited in oblong groups, like the *Limnæi* or Pond Snails, on the stems and leaves of fresh-water plants. (See *Pfeiffer*, *Moll.* t. 6. f. 10, 11, 12.)

M. Moquin Tandon erroneously considers the *Hydrobia* of Hartmann, which has a subspiral horny operculum, as a sub-genus of *Bithinia*, under the name of *Bythinella*, and gives the name *Elona* to the true *Bithiniæ*.

3. 1. Bithinia *tentaculata*. Tentacled Bithinia. — Shell oval-oblong, yellowish horn-colour, smooth, semitransparent, with five rather flat volutions, and without umbilicus. (t. 10. f. 120.)

Helix tentaculata. *Linn. Fauna Suec.* 531. (*List. Ang.* t. 2. f. 19.); *Gmel.* 3662.; *Mont.* 389. — Bulimus tentaculatus. *Poiret*, 61.—Lymnea tentaculata. *Flem. Ed. Ency.* vii. 78. — Nerita jaculata. *Müller, Verm.* ii. 185. — Bithinia jaculator. *Leach, Syn. Moll.* 209.; *Risso, Eur. M.* iv. 100. — Bithinia tentaculata. *Gray, Man.* 93. t. 10. f. 120.; *Forbes and Hanley, B. M.* iii. 14. t. 71. f. 5. 6. t. H. H. f. 3. — Turbo Janitor. *Vall. Exer. H.N.* 6. — Turbo nucleus. *Da Costa*, t. 5. f. 12. — Paludina tentaculata. *Flem. B. A.* 315. — Paludina impura, *Lam.* vi. 175. (*List. Conch.* t. 132. f. 32.); *Brard*, 183. t. 7. f. 2.; *Turton, Man.* 134 f. 120. — Cyclostoma impurum. *Drap.* 36. t. 1. f. 19.; *Sturm, Fauna*, t. vi. 3. 1.

Young. — Turbo lævis (?). *Walker*, f. 33. — Nerita sphærica. *Müller.*

Var. 1. Shorter, less, and more conical. *Drap.* t. I. f. 20.

In ditches and canals; common all over Britain.

Animal blackish, with golden dots; foot two-lobed in front, narrow and subacute behind; tentacle setaceous, long; the eyes black.

Shell half an inch long, and three-tenths wide, often covered with a blackish foul coat; spire composed of five volutions, the first very tumid, the others hardly raised; pillar without umbilicus.

4. 2. Bithinia *ventricosa*. Ventricose Bithinia. — Shell conic, yellowish horn-colour, smooth, semi-transparent, with five very tumid volutions, and a small oblique umbilicus. (t. 10. f. 121.)

Bithinia ventricosa. *Gray, M. Rep.* 1821, p. 239.; *Man.* 94. — Turbo Leachii. *Sheppard, Linn. Trans.* xiv. 152. 1822. —

Bithynia Leachii. *Leach, Syn. Moll.* 209; *Forbes and Hanley, B. M.* iii. 16. t. 71. f. 78. t. H.H. f. 1. — Paludina Trochelliana. *Philippe.* — Paludina Kickxii. *Vestend, Bull. Acad. Brux.* 1835, 375. — Paludina decipiens. *Mich. Mag. Zool.* 1843, 2. t. 64. f. 2. — Paludina Michaudi. *Duv. in Rev. Geol.* 1845, 211. — Bithinia Kickxii and B. Michaudi. *Dupuy, Moll.* — Paludina acuta. *Fleming. Br. Anim.* 315.— Cyclostoma simile. *Drap.* 31. t. 4. f. 15. (?) —Paludina ventricosa. "*Leach, MSS.;*" *Sheppard, Brown, Brit. Shells*, t. 41. f. 74, 75. — Paludina humilis. *N. Boubée, Cat.* —Paludina similis. *Turton, Man.* 135. f. 121. *Alder, Mag. Zool. and Bot.* ii. 116.

In ditches and canals; often even where the water is slightly brackish; south of England. (*Gray*, 1821.)

Shell a quarter of an inch long, and two lines broad, with four or five very tumid volutions; aperture dilated, nearly circular, projecting more outwardly, or out of the line of the columnar axis, with a small umbilicus behind it.

The fry, or mass of egg, of this species, are disposed on a tough strap-shaped green membrane, in a double row, consisting of six or seven pairs placed opposite to each other; and this elongated receptacle is fixed to the under surface of aquatic plants.

Mr. Sheppard received it from Dr. Leach, under my name, but he changed it to *Turbo Leachii.* I do not think it is *C. simile* of Draparnaud: in Dr. Turton's figure the volutions are scarcely sufficiently ventricose.

The shell is often covered with a ferruginous incrustation, and the apex of the spire is sometimes eroded.

Mr. Alder observes (*Mag. Zool. and Bot.* ii. 116.), "The *Paludina viridis* of Turton's Manual (ed. 1.

135, f. 122.) I take to be the young of *P. similis* (*Bithinia ventricosa*), judging from specimens in Mr. Clark's cabinet." Most probably this idea is correct, as I have not been able to find any authority for Draparnaud's species being found in this country; and it is to be remarked that Turton's account is taken from Draparnaud, and Dr. Turton does not give any habitat for the species. M. N. Boubée's specimen of *Pal. viridis* proves it to be a *Hydrobia* or minute *Littorina*: it has a horny subspiral operculum.

Mr. Alder also thinks that the *Paludina stagnorum* Turton, Man. (ed. 1. 136. f. 123.) may probably be a mere slender variety of this species. (*Mag. Zool. and Bot.* ii. 116.) I think it is much more probably a *Littorina*, as he considers it the same as *Paludina acuta* of Drap. In the absence of specimens, it is impossible to decide; and, as Dr. Turton does not give any locality, it is even doubtful if the whole account of the species and figures were not derived from Draparnaud's work. If intended for any British species, it must be *Littorina ventricosa*, which is common in the ditches with *Cardium edule*, &c. near Tilbury Fort.

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## Fam. 4. VIVIPARIDÆ.

Head annulated, contractile, broad, extended to the plane of the foot. Teeth in 7 longitudinal series; the lateral broad, ovate, converging. Jaws 2, lateral, horny, narrow, sharp-edged,

smooth, resembling the lateral jaws of *Lymnea* (*Moquin*, t. 40. f. 5.), and advance horizontally one against the other. Tentacles conical, cylindrical, blunt, and unequal; the right larger, swollen at the base. Eyes on short tubercles, on the outer side of the base of the tentacles. Mantle simple in front; neck with a small lobe on each side. Gills single, formed of three series of flat filaments, and forming an oblique line down the left side of the branchial cavity, and bent at the end. (*Moquin*, 76. t. 40. f. 2. 12. 13.) The foot ovate, much dilated, extended before the muffle, and with an anterior groove. Male organ inclosed in the swollen base of the right tentacle. Viviparous. Shell spiral-ovate, covered with a hard olive periostraca. Aperture ovate; peristome simple. Operculum ovate, annular; nucleus sublateral, horny, without any shell-coat.

1. PALUDINA *Lam.* (Marsh Shell.)

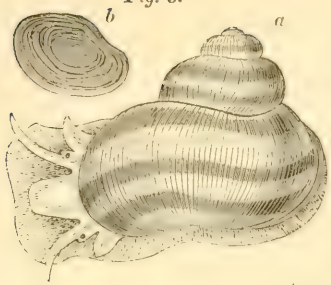
Operculum horny, the nucleus rather on the inner side; shell conoid or oblong; mouth roundish, slightly angular behind; peristome united all round, thin.

They are called *Paludinæ* from their being found in marshes and ditches.

The animals are viviparous, the young being hatched while the eggs are in the oviduct of the mother.

The shells of the newly-hatched individuals are covered with spiral bands of cilia.

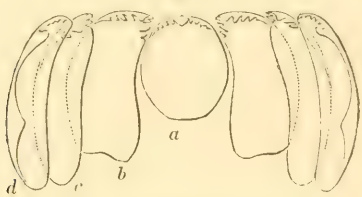
*Fig.* 5.




*Paludina crystallina.*
*b*, operculum.

The lingual band is strong, slender, elongate; teeth laminar, longitudinal, subovate, apex recurved, the middle lobed, and obtusely toothed on each side; the lateral teeth nearly similar, slightly curved, apical edge denticulated on each side; the inner shorter and broader, the outer teeth winged on the outer edge (fig. 6.).

*Fig.* 6.




*Teeth of Paludina vivipara.*
*a*, central; *b*, *c*, *d*, lateral teeth.

5. 1. PALUDINA *crystallina*. Crystalline Marsh Shell. — Shell thin, oval, acute, volutions five, much inflated, with three brown bands; the suture deeply impressed; spire blunt mucronate. (t. 10. f. 118.)

Helix vivipara. *Schræt Flusse*, 330. t. 8. f. 2.—Cochlea vivipara. *Da Costa, B. C.* 81. t. 6. f. 2.—Helix vivipara.—*List. Ang.* t. 2. f. 17.; *Petiv. Mus.* 84. n. 814.; *Donovan, B. S.* iii. t. 87.;

*Montagu, T. B.* 386. — Paludina crystallina. *Gray, Med. Rep.* 1821, p. 239. — Paludina Listeri. *Forbes and Hanley, B. M.* iii. 8. t. 71. f. 16.—Cyclostoma achatinum. *Drap. Moll.* 36. t. 1. f. 18. — Paludina achatina. *Sow. Gen.* f. 2. — Paludina contecta. *Moq. Tand. Moll. F.* ii. 512. t. 40. f. 1. 24. — Vivipara communis. *Dupuy, Moll. Franc.* 537. t. 27. f. 5. — Natica vivipara. *Ferussac.* — Cyclostoma contectum. *Mill. Moll. Maine and Loir. 5.* 1813. — Nerita fasciata. *Müller Verm.* ii. 182. part. — Nerita vivipara. *Müller*, ii. 182. — Cyclostoma viviparum. *Drap.* 34. t. 1. f. 16, 17. — Paludina vivipara. *Lam.* vi. 173.; *Nilson*, 88.; *Turton, Man.* ed. 1. 133. f. 118.; *Brard*, 174. t. 7. f. 1.; *Rossm.* f. 66.; *Desh.* viii. 511. — Viviparus fluviorum. *De Montf.* ii. 247. — Paludina achatina. *Sow. Gen.* f. 1.; *Leach, Syn. Moll.* 208.

In still waters and slow rivers far from the sea.

Shell an inch and a quarter long, and an inch broad, thin, transparent, finely striate longitudinally, of an olive colour, with three brown bands on the larger volution; spire composed of five inflated and deeply divided volutions, the last very large, the first a mere point; aperture pear-shaped, slightly produced at the upper angle; the inner lip a little reflected so as to half-close the umbilicus. The young shells are subglobose, pellucid, obscurely banded, rather flattened above, and furnished with five ciliated lines.

6. 2. PALUDINA *vivipara.* Common Marsh Shell. — Shell rather thin, conic-oval, acute; volutions six, rather tumid, with three olive-brown bands; the sutures well-defined. (t. 10. 119.)

Helix vivipara. *Linn. Fawn. Gall.* ii. 529. *S. N.* part. 1247.—Helix ventricosa. *Oliv. Ad.* 178.—Helix fasciata. *Gmelin, S N.* 364. *b.*—Helix ventricosa. *Olive, Zadoral.* 178.—Paludina vul-

garis. *Gray, Med. Rep.* 1821, p. 239.; *Leach, Syn. Moll.* 207. —Paludina fasciata. *Desh., Lam.* vii. 513.—Nerita fasciata. *Müller, Verm.* 182.— Cyclostoma achatinum. *Drap.* 36. t. 1. f. 18.—Turbo achatinus. *Sheppard, Linn. Trans.* xiv. 125. t. 1. f. 18.—Paludina achatina. *Brug. E. M.* t. 458. f. 1.; *Lam. H.* vii. 174.; *Rossm.* 109. f. 66*.; *Turton, Man.* 133. f. 119. — Helix vivipara b. *Gmelin. S. N.* 36. 46.—Nerita fasciata. *Sturm. Faun.* vi. 2. t. 12.—Cochlea vivipara. *Da Costa B. C.* 71. t. 6. f. 2.—Vivipara fluviorum. *De Montf.* 246.—Limnæa vivipara. *Flem. E. Ency.* vii. 77.—Paludina vivipara. *Say, Amer. Conch.* t. 10; *Forbes and Hanley, Brot. Moll.* iii. 11. t. 71. f. 14. 15. t. H. H. f. 2.—Vivipara fasciata. *Dupuy. Moll. Franc.* 540. t. 27. f. 8.

Young shell with numerous hairy bands: Helix compactilis. *Pulteney, Col. Dorset.* 48.

Very young shell: Vitrina femorata. *Auctor.*

Inhabits the upper parts of rivers, where the water is not brackish.

Shell resembling the last, but of a more oblong shape, with six volutions, which are not so much swollen, and consequently the sutures are not so deep. The young shells are furnished with numerous close ciliated spiral lines. Lister gives the anatomy of the former species, and Cuvier of this (t. 6. f. 1. 4.), in the *Mém. Mollusques.*

Though Lister has figured the two species as found in Britain, they had been confounded by English conchologists until I noticed them in the *Medical Repository* for 1821, when I also pointed out that they were known to Lister, and that the young shell of the two species offered the very different characters noticed in their descriptions. They are sometimes found together in the same river, as at Uxbridge, Middlesex.

Messrs. Forbes and Hanley have changed the name which I gave to the new species, because the

species was "not characterised:" overlooking the fact that I pointed out the very marked difference between them found in the young shell; thus firmly establishing the distinction which some conchologists had only considered as a sexual peculiarity, the most ventricose being the female.

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## Fam. 5. VALVATIDÆ.

Rostrum annulated, elongate, bifid. Tentacles equal, elongate, tapering, rather blunt; eyes on a small tubercle on the inner side of their base. Jaws, two, lateral, narrow, approaching each other above, where there is a third rudimentary jaw, like a small tubercle. (*Moquin*, 32. t. 41. f. 6.) Mantle-edge thin, with a tentacle-like appendix on the right side, which has been called the branchial thread. Vent on the right side, under the mantle. Gills plumose, exserted when the animal is expanded, formed of an oblong, tapering, conical process, furnished on each side with a series of spirally-twisted laminæ, placed opposite to each other. (f. 9. *b*.) Foot truncated, nicked slightly, and produced at each angle in front, rounded behind. The male organ is like a third tentacle, situated behind the base of the right tentacle; the orifice of the female organ is under the collar on the right side of the vent. (*Moquin*, t. 41. f. 5.) "Hermaphrodite;" oviparous; eggs emitted singly; fluviatile, eating aquatic plants; rarely

swimming. Shell conical, thin, covered with an olive periostraca; mouth round, with a continued simple peristome. Operculum horny, suborbicular, formed of many gradually enlarging whorls, which have a raised membranaceous outer edge, forming a spiral ridge on the outer surface (f. 9. *b.*).

The shells are known from Paludinæ by the shelly cone being circular, and not bent in in any part by the proximate whorls.

1. VALVATA *Müller.* (Valve Shell.)

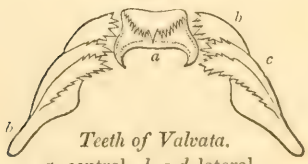
Shell with the spire a little elevated, or flat and disk-like; aperture quite circular, united all round, and furnished with a horny operculum marked with a single raised spiral membranaceous line.

So named from the valve or lid which covers the orifice of the aperture.

7. 1. VALVATA *piscinalis.* Stream Valve-shell.—Shell globular, with an elevated obtuse spire, and a deep central umbilicus. (t. 10. f. 114.).

The lingual plate of *V. piscinalis* is elongate; the central tooth subquadrate, base produced on both sides, incurved, cutting edge triangular, the middle cusp with a pectinated lobe on each side; lateral teeth somewhat similar, laminaceous, toothed on

*Fig.* 7.




*Teeth of Valvata.*
*a*, central; *b*, *c*, *d*, lateral.

each side; the apical denticules larger than the rest. (Fig. 7.)

Nerita piscinalis. *Müller*, 172. — Trochus cristatus. *Schroet, Fluss-conch.* 280, t. 6. f. 11. — Valvata obtusa. *Brard*, p. 190. t. 6. f. 17.; *Turton, Man.* ed. 1. 130.; *Pfeiffer*, 198. t. 4. f. 32. t. 1. f. 13. — Valvata fontinalis. *Leach, Syn. Moll.* 206. — Turbo cristata. *Poir. Prod.* 29. — Nerita obtusa. *Studer, Coxe's Travels*, iii. 436. — Cyclostoma obtusum. *Drap.* p. 33. t. 1. f. 14. — Turbo fontinalis. *Mont.* p. 348. t. 22. f. 4. — Turbo thermalis. *Dillwyn*, p. 852. — Helix piscinalis. *Gmel.* 3627. — Valvata piscinalis. *Lam.* vi. 172.; *Kenyon, Mag. N. Hist.* iii. 425. f. *b. c. d.*; *Alder, Mag. Zool. and Bot.* ii. 116. — Lymnea fontinalis. *Flem., Ed. Ency.* vii. 78. — Nerita pusilla. *Müller, Verm.* 171.

Young rather depressed, umbilicus rather wider. — Helix fascicularis. *Gmelin, S. N.* 3641.; *Alten Syst.* 74. t. 8. f. 16. — Valvata depressa. *Pfeiffer, D. Moll. J.* 100. t. 4 f. 33. — Valvata minuta. *Drap. Hist. Moll.* 42. t. 1. f. 36. 38. — Valvata Moquiniana. *Dupuy, Moll. Franc.* 586. t. 28. f. 15.

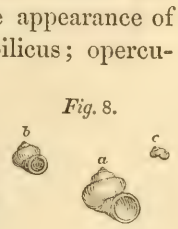
In canals and ponds; common to all parts of England.

Animal whitish; trunk grey, rugose.

Shell nearly a quarter of an inch long and as much broad, globular, thin, light horn-colour, very finely spiral-striate, and marked with some obscure concentric lines; spire of four volutions, tumid, and deeply defined, and having much the appearance of a *Trochus*, with a deep central umbilicus; operculum dull greyish white.

Varieties: — 1. Shell high, umbilical; cavity small. 2. Shell depressed, umbilicus deep; also varying much in size, some specimens being three or four times as large in the adult age as others.

*Fig.* 8.




Some continental naturalists, overlooking the fact

that all conoid shells are more depressed in their young state, have, from the peculiarity of their formation, regarded the young as a distinct species under the name of *Valvata depressa.* (See f. 8. *a. b. c.*)

The animal and operculum are well described by Montagu (*Test. Brit.* 351.), who justly compared the animal to that of the next species, though in his arrangement one shell is a *Turbo* and the other a *Helix;* but he saw the difficulty of this arrangement. See his note at p. 367., and also at p. 461., where he describes the animal of *V. cristata.*

8. 2. VALVATA *cristata.* Crested Valve Shell.—Shell discoid, flat above, and umbilicate beneath; whorls 3. (t. 10. f. 115.)

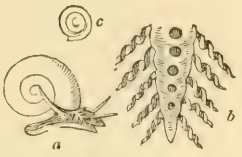
Valvata cristata. *Gray, Man.* 98; *Müller, Verm.* 198.; *Alder, Mag. Zool. and Bot.* ii. 116.; *Forbes and Hanley, B.M.* iii. 20. t. 71. f. 11. 12, 13.—Valvata spirorbis. *Drap.* p. 41. t. 1. f. 32, 33.; *Brard,* p. 187. t. 6. f. 15, 16.; *Turton, Man.* ed. 1. 131. f. 115.—Valvata Mülleri. *Leach, Syn. Moll.* 205. Nerita valvata. *Gmel.* 3675.—Helix cristata. *Mont.* p. 46.; *Vign.* 1. f. 7, 8.—Planorbis cristatus. *Flem. Ed. Ency.* vii. 69.—Trochus cristatus. *Maton and Racket, Linn. Trans.* viii. 167.—Turbo cristatus. *Turton, Dict.* p. 227.—Valvata planorbis. *Moll.* 42.; *Drap. Tab.* 41. t. 1. f. 34, 35.; *Turton, Man.* ed. 1. 132. f. 116. (?)—Valvata pulchella. *Studer, Coxe's Trav.* iii. 436.—Valvata branchialis. *Gruithuisen, Nov. Act. Nat. Cur.* x. 1821, 437. t. 38. f. 13.—Junior. Valvata minuta. *Drap.* 42. t. 1. f. 36—38.; *Turton, Man.* ed. 1. f. 117.

In ditches and canals, on aquatic plants.

Shell about the tenth of an inch in diameter, pale horn-colour, striate transversely, with three volutions; the upper surface a little sunk, the under side umbilicate, so as to expose the interior volutions.

Mr. Alder observes (*Mag. Zool. and Bot.* ii. 117.), "Dr. Turton has introduced two other species, *V. planorbis* Drap. (f. 116.), and *V. minuta* Drap. (f. 117.), into his Manual, but no specimens of them are now to be found in his cabinet." Mr. Alder says he took some pains to investigate these two species when in Paris, on examining three of the principal collections there; those of the Jardin des Plantes, the Baron de Férussac, and the Duc de Rivoli. "In the latter only, I found any thing under the name of *V. planorbis*. The specimens (which were originally Lamarck's) were *V. cristata* Müller. M. de Férussac had specimens, under the name of *V. minuta*, from two different individuals. Those from M. Pfeiffer are, I think, the young of *V. cristata*, and the others (I forget from whom, but with the name of Draparnaud) the young of *V. piscinalis*. Mr. Miller introduced *V. minuta* into his catalogue of the land and freshwater shells of the environs of Bristol, but no specimen of it is preserved in the Bristol Museum. Dr. Turton says that his *V. minuta* is the *Helix serpuloides* of Montagu. This is well known to be a marine shell, referrible to the genus *Skenea* of Fleming. Mr. Thompson of Belfast has, however, favoured me," continues Mr. Alder, "with the examination of a shell which may possibly turn out to be the *V. minuta* Drap., though I suspect it to be marine."

*Fig.* 9.




*a*, animal; *b*, gill; *c*, operculum.

Dr. Gruithuisen describes the operculum as formed of concentric rings: this is very pardonable, as it is very easy to overlook its spiral character.

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## Fam. 6. ACICULIDÆ.

Muzzle annulated, produced. Tentacles subulate, not swollen at the end. Eyes large, on the back of the neck, rather behind, and between the base of the tentacles (fig. 10.). Gills vascular; jaws none. Foot oblong; divided across in the middle. Male organ large, at the hinder part of the base of the right tentacles, exserted like a third tentacle. Shell spiral, sub-turreted; aperture oblong; peristome simple; outer lip rather dilated, sinuous. Operculum horny, spiral, of few rapidly enlarging whorls. Terrestrial, unisexual.

On account of the shape of the shell, the animals have been placed with *Bulimi*.

When the animal was first discovered it was then arranged with *Auriculidæ*, on account of the position of the eyes. But M. Férussac (*Dict. Class. H. N.* ii. 90.), in 1822, first noticed the operculum; and it has been more lately described by Mr. Alder, the Abbé Dupuy, and others.

The animal is very rapid and irritable, but comes out of the shell with great hesitation. It carries the shell horizontally when it walks. Preferring dampness, it hides itself from the sun, secreting

abundance of very clear aqueous mucus. It often leaves half the foot exposed when all the other parts are withdrawn.

### 1. Acicula.

Shell subcylindrical, with a blunt tip; mouth ovate, simple, outer lip simple, thin, slightly reflexed over the pillar, forming a slight perforation. Animal with two long contractile slender tentacles, between which and the eyes, at their hinder base, are two jagged blackish spots (fig. 10.).

*Fig.* 10.

Dr. Turton (*Manual*, ed. 1. p. 83.) appears to have considered the spot at the base of the tentacles as the rudiment of a lower pair. Dr. Hartmann (*Sturm, Fauna*, t. 1. f. 4.) describes the tentacles as retractile; but he uses the same term to describe the tentacles of *Cyclostoma* and *Carychium*, which agree with these in only being contractile, and not retractile like those of *Helices*, and other land Mollusca.

This genus, on account of the similarity of its shell, has been confounded also with *Truncatella* of Risso, which is a marine animal, provided with gills and a distinct operculum.

The animal walks with its shell nearly perpendicular, twisting it round in a very odd manner, and then letting it suddenly fall again.

9. 1. Acicula *fusca*. Brown Acme. — Shell cylindrical, obtuse, glossy brown, transparent, with

rather distant parallel oblique longitudinal striæ. (t. 6. f. 66.)

Helix Cochlea. *Studer*, *Coxe's Travels*, 430.—Auricella lineata. *Jurine*, *Helv. Aln.* 187. 33. — Acmea lineata. *Hartm. Sys. Gast.* 1821, 49.—Turbo fuscus. *Boys and Walker*, *Test. Min. Rar.* 12. t. 2. f. 42.; *Montag. Z. B.* 330.; *Wood*, *Supp.* t. 6. f. 15.— Auricula lineata. *Drap. Hist.* 57. t. 3. f. 20, 21.— Carychium cochlea. *Studer*, *Catal.* 21.— Carychium lineatum. *Férussac*, *Tab. Syst.* 100.; *Rossm.* v. 54. t. 28. f. 408. — Cyclostoma lineatum. *Férussac*, *Dict. Class. H. Nat.* ii. 90. — Pupula lineata. *Charp. Moll.* 8. 22. — Carychium acicularis. *Fér. Dict. S. N.* vii. 188. 1817. — Acicula lineata. *Hartm. N. alpina.* 215. 1821. — Acicula fusca. *Pfeiffer*, *Pneum.* iii.; *Gray*, *Cat. Cyclophoridæ*, *B. M.* 68.— Acme lineata. *Hartm. in Sturm*, *Fauna*, vi. t. 2. 1828.; *Alder*, *Trans.* ii. 338.— Acme fusca. *Gray*, *Man.* 223. t. 6. f. 66.; *Forbes*, *Brit. Moll.* t. 125. f. 7.— Acme minuta. *Brown*, *H. C.* t. 14. f. 26. (?); *Forbes and Hanley*, *B. M.* 204.— Truncatella lineata. *Hart. Gast.* t. 1.— Carychium fuscum. *Fleming*, *B. A.* 270.; *Jeffreys*, *Linn. Trans.* xvi. 364.— Bulimus lineatus. *Drap. Tabl.* 67.; *Turton*, *Man.* ed. 1. 82. f. 66.

Inhab. on moss and Jungermanniæ, in damp places, springs, &c.

Shell the tenth of an inch long, of a cylindrical form, and hardly decreasing in diameter for its whole length, highly polished and marked with rather remote regular longitudinal striæ, which are hardly distinguishable without a good glass; spire composed of six very slightly raised but well-defined volutions, the two terminal ones of which are smaller and paler; aperture roundish-oval, with the margin thin, and a little reflected at the pillar, where it forms a slight perforation.

The animal and shell are sometimes dark brown and at others pale yellowish white. They are sometimes found reversed.

M. Moquin Tandon, who is not addicted to dividing species with too great minuteness, divides these shells into four species, and separates them into two sub-genera; I have not been able to verify the accuracy of the subdivision.

1. Auricella. *Shell with elevated ridges. Aperture sinuous, slit obliquely in the front part in a line with the suture.*

A. (Auricella) lineata, t. 38. f. 4—7. — Shell reddish yellow, with distant ridges, whorls rather depressed; aperture with a short oblique slit; the peristome sub-continuous. (Auricula lineata. *Drap. Hist.* t. 3. f. 2021.) The shell is sometimes nearly smooth.

2. Platyla. *Shell smooth, aperture flat, without any slit in the upper part.*

A. (platyla) fusca, t. 38. f. 8. 16. — Shell very smooth, reddish yellow; whorls slightly convex, peristome nearly continued. (Turbo fuscus. *Walker, T. M. Rar.* 112. f. 42. — Aurychium lineatum. *Ross. Jun.* f. 408.)

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## Order II. *SCUTIBRANCHIATA.*

Gills consisting of two series of lamellæ, forming one or two series over the back of the neck, or under the edge of the mantle round the foot; rectum often traversing the heart. Animal herma-

phrodite, self-impregnating (?). Shell spiral, or conical, symmetrical.

With the single exception of *Neritina* and *Proserpina*, all the animals of the sub-order are marine.

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## Fam. 1. NERITIDÆ.

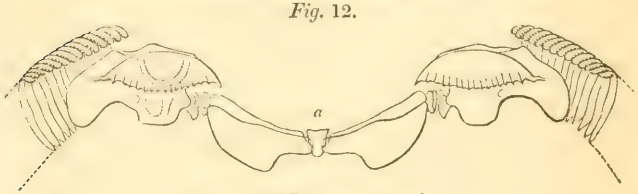
Muzzle very short, annulated, provided with a hood; jaws two, one above and the other below, both toothed on the edge. Tentacle contractile, subulate, pointed. Eyes on short pedicles at the base

*Fig.* 11.

*Neritina fluviatilis.*
*a*, foot below; *b*, head above; *c*, operculum inside.

of the tentacles (fig. 11. *b*.). Tongue membrane broad, with very numerous series of transparent glass-like teeth; the central teeth (fig. 12.) very

*Fig.* 12.




*Teeth of Neritina fluviatilis.*
*a*, central.

unequal; the second and fifth on each side large, broad, dark-coloured; the lateral teeth

very numerous, sub-similar, very slender, curved at the top; the inner one on each side largest. Body and shell spiral. Gill single, formed of small leaves placed symmetrically one against the other, and forming a transverse mass on the back under the mantle. Sides of the foot without any membranaceous fringe, with beards on its upper surface. Foot oblong, shorter than the shell, circular, truncated behind. Shell hemispherical, flat beneath; spire lateral; inner lip flattened, transverse; outer arched; inner surface not pearly. Operculum with a process on the inner side under the nucleus, forming a kind of hinge with the edge of the inner lip of the shell. (Fig. 13.)

*Fig.* 13.

*Neritina fluviatilis.*

The peculiar structure of the operculum makes this family more closely resemble the bivalve shells: the processes appear to answer the same purpose (that of keeping the two parts in their proper situation) as the teeth of the hinges in the bivalves.

In the exotic genus *Navicella*, which, on account of its large mouth, has been confounded with the *Patellæ*, the processes occupy the greater part of the operculum.

There is only a single fluviatile genus of this family found in Britain.

### 1. NERITINA *Lam.* (Neritine.)

Shell half-ovate, thin; inner lip slightly toothed; operculum only slightly calcareous, and fur-

nished with a sharp flexible outer edge; foot short, rounded at each end.

This genus is separated from the marine *Nerita* by the pillar being sharp, only slightly denticulated, and the outer lip not being toothed within.

*Neritina* is the diminutive of *Nerita*, the ancient name of a sea-shell.

The greater part of the species are confined to freshwater streams, but one of the North American species is found for 200 miles up a river, from the mouth where it is quite salt, to beyond the reach of the tide, where the water is perfectly fresh. One species (*Neritina viridis*) is only found in the sea. (See *Phil. Trans.* 1835.) They live on vegetable substances, crawl slowly, and have not been observed to swim on the surface of the water.

They deposit their eggs on the surface of their shells; these are roundish, and provided with a thick opaque coriaceous case; and when the animal hatches, the upper part separates from the lower by a circular slit, like the lid of a box, the base remaining adherent to the shell.

M. Deshayes and several other conchologists, especially those who only study the external form of shells, have proposed to unite this genus to the *Nerites*, because some of the species are marine, and some of the fluviatile species have a tooth on the pillar lip. The genera are, however, very distinct; and they may be well characterised by the structure of the operculum. (See *Phil. Trans.* 1833, p. 814.) The operculum of the *Neritinæ* is solid, shelly, and furnished with a thin flexible outer edge; that of

the *Nerites* is horny, covered on both sides with a hard shelly coat. The position of the horny operculum is shown by a groove in the edge between the two coats; and if a knife is inserted, the coats can be separated from the operculum.

As the periostraca is essential to the structure of the shell, and is always present, some shells being formed of scarcely any thing else, so it is with the operculum, the horny part similar to the periostraca of shells being always present, and forming its essential part, and a shelly coat being in some instances added to the outer surface, as in *Turbo* and *Phasianella*, or to the inner surface, as in this genus, in which the horny part is very thin and scarcely visible, except where the shelly coat is very thin, as at the flexible edge.

These animals absorb the septa which separate the whorls of the spire, when they have arrived at their full size, so as to allow more room for the spiral body, without increasing the size of the shell; and this can be done without endangering the strength of the shell, as only a very small part of the whorl is exposed on the surface. A similar absorption is to be observed in many *Auriculidæ*, and to a less extent in the *Cones*, where the septa are only reduced in thickness. (See *Phil. Trans.* 1833, p. 798.)

This absorption is only superficial, and produced by that portion of the surface of the mantle which lies close to it, and is not to be confounded with the absorption of the bones of vertebrated animals, where it is produced by vessels which ramify in the substance of the bone, and which are accompanied by

other vessels to replace with new portions the part which has been removed.

The apices of the spires of these shells are sometimes eroded; those are more so which live in stagnant or nearly stagnant waters. The late Mr. Sowerby (*Min. Conch.* iv. 49.) supposed that this was produced by "some acid developed during the fermentation of vegetable matter in marshes or at the bottoms of the rivers." Others, who were not aware how the animals walked, have said that this erosion of the apex was produced by the animal rubbing it against the ground in progression; explaining also the erosion of the umbones of the *Uniones* in the same manner.

Dr. Shuttleworth believes that the erosion of the apex of some of the fluviatile *Neritinæ* is caused by the animal's filing off the apices by its teeth, the mark of the teeth being left on the surface of the erosion. This is particularly the case with the specimens which live in streams in granitic countries. And he suspects the animals supply themselves with the calcareous matter to form their shell from this source, the body of the *Neritinæ* being withdrawn from the top of the shell as the shell is enlarged in size.

10. 1. NERITINA *fluviatilis*. River Neritine. — Shell convex, dilated, tessellate, with variously coloured spots; spire short, lateral. (t. 10. f. 124.)

Neritina fluviatilis. *Lamarck*, vi. ii. p. 188.; *Flem. B. A.* 321.; *Turton, Man.* ed. 1. 138. — Neritina europæa. *Leach, Syn. Moll.* 181. — Nerita fluviatilis. *Linn. S. Nat.* 1253.; *Müller*,

ii. 194.; *Drap.* p. 31. t. 1. f. 1—14.; *Brard*, p. 194. t. 7. f. 9. 10. 12.; *Mont.* p. 470.; *Turt. Dict.* 127.; *Forbes and Hanley*, *B. M.* iii. 3. t. 71. f. 1. 2. t. H. H. f. 1. — Nerita fontinalis, *Brard*, *Coq. Par.* 196. t. 7. f. 11. — Neritina zebrina, N. peloponnensis. N. numidica, N. Mittreana. *Recluz.* — Neritina intexta. *Villa.* — Neritina Sardon and N. trifasciata. *Menke.* — Neritina Hildreichii. *Schwerz.* — Nerita Bourguignati. *Recluz*, *Jour. Conch.* 1825, 293. — Nerita Prevostiana. *Pfeiffer*, *D. Moll.* iii. 49. t. 8. f. 11, 12. — Nerita thermalis. *Boubee in Bull*, 1833, 12.— Theodoxus lutetianus. *De Montfort*, ii. p. 351. — Neritina fontinalis. *Brard*, *Hist. C.* 196. t. 7. f. 11. 13.; *Pet. Gaz.* t. 91. f. 3.; *List. Conch.* ii. 1. 38.; *Swamm. B. N.* 80. t. 10. f. 2. — Neritina dalmatica. *Sow. C. Illus.* f. 57.— Neritina variabilis. *Hecart. Moll. Vall.* 1. 146.

In slow rivers, adhering to stones.

Animal white; head and back of the neck blackish; hinder part of the foot sometimes black spotted; tentacle long, white, with blackish line.

Shell about three eighths of an inch long, and two broad, convex above and flat underneath, obscurely striate transversely, of a greenish or whitish colour, variously chequered with spots or bands of white, brown, purple, or pink; spire consisting of three volutions, the first very large, oblong, and oblique, the others small and lateral; aperture horizontal, semielliptic, with the margin sharp and entire; pillar white, transverse, sloping down to a sharp edge, and quite entire; operculum semilunar, yellowish, with an orange border, and underneath is a strong raised grooved spire at one end.

The shells are often covered with calcareous incrustations, deposited by the water, which make them look like pieces of dirt, and thus escape being seized on by the fish.

The continental conchologists have described se-

veral species allied to the above. Rossmässler reduces them to three; but, from the specimens which I have received under different names, I greatly doubt if they are more than mere local varieties of our species. Nilson found a small variety or species in Sweden, on the shores of the Baltic, with *Mytilus edulis*, *Cardium*, &c. Our species has been found in similar situations in Loch Stennis, Orkney, by Mr. Edward Forbes.

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## Order V. *PNEUMONOBRANCHIATA.*

The respiratory organs consisting of a number of pulmonary vessels spread over a closed bag-like cavity on the back of the neck. The edge of the mantle adherent to the back of the neck of the animal, forming a closed pulmonary chamber, leaving only a hole for the entrance and exit of the air, which is closed by an external valve on the side of the cavity. They breathe free air, and either live constantly on the land or in the water, in which latter case they come periodically to the surface to respire. The larvæ are shell-bearing, shaped like the adult, and destitute of any cephalic fins. The lingual membranes are furnished with numerous longitudinal series of similar, sub-equal, teeth.

The shell is rarely wanting.

They are all destitute of any operculum, but close the shell, during the torpidity of the animal (produced by either dryness or cold), with a lid or epi-

phragm formed of its inspissated humours, and sometimes hardened with a little calcareous matter.

These animals are all hermaphrodite, but require mutual impregnation, and feed on vegetables; but some few have carnivorous propensities, and others, when they live near man, acquire bad habits, and eat paper and dead animal matter.

They may be divided into groups, according to the structure of the mouth, and the form of their tentacles, which conform to their more or less aquatic habits.

This order is divided into four sub-orders, in the following manner: —

I. PETROPHILA. — Eyes at the end of an elongated contractile peduncle; tentacles flat, contractile; jaws none; organs of generation far apart, apertures united by a lateral groove; teeth flat, four-sided, close, side by side; shell none, as *Onchidiadæ*.

II. GEOPHILA. — Eyes at the end of an elongated retractile peduncle; tentacle cylindrical, retractile, sometimes wanting; organs of generation in a common cavity; operculum none. Terrestrial.

1. *Lumbricivora.* — Mouth proboscis-like; jaws none; teeth slender, conical, distant. Carnivorous, subterraneous, as *Testacellidæ*.
2. *Phyllivora.* — Mouth prominent; jaws one or two, distinct; teeth four-sided, flat, with a recurved tip, close together, side by side; herbivorous, as *Arionidæ* and *Helicidæ*.

III. Limnophila. — Eyes sessile; tentacles two, subcylindrical, or depressed, simply contractile; jaws two, or three, distinct; teeth numerous, flat, with a recurved tip; orifices of generation separate, but near; operculum none, as *Auriculidæ* and *Limniadæ*.

IV. Thalassophila.—Eyes sessile, on the back of the frontal disk, formed of the united expanded tentacles; jaws distinct; teeth numerous, flat, close, side by side; operculum none, or distinct. Marine.

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## Sub-order I. *Petrophila.*

Eyes at the end of an elongated contractile peduncle; tentacles flat, contractile; organs of generation far apart, apertures united by a lateral groove; jaws none; teeth numerous, four-sided, flat, close together, side by side*; shell none. Fluviatile, or marine.

### Fam. 1. ONCHIDIADÆ.

Body ovate or oblong, mantle, covering the whole of the back, edging the foot, convex, more or less tubercular; tentacles and eye peduncles contractile; aperture of respiration on the hinder

* The teeth described as those of Peronia Mauritiana in the *Annal. and Mag. of Nat. Hist*, Nov. 1853, were those of *Testacellus*, which had been sent to me wrongly named. See *Ann. and Mag. N. H.*, Jan. 1854.

part of the groove between the mantle and the foot; foot narrowed; shell none.

On rocks near the sea covered with the tides.

### 1. Onchidium.

Animal oblong; mantle completely covering the back, convex, coriaceous, tuberculated; eyes two, at the end of cylindrical retractile peduncles; tentacles none, or in the form of rounded oral lobes or a buccal veil; jaws none, tongue denticulated; orifice of reproductive organs widely separated; pulmonary cavity behind the heart, with the aperture posterior, between mantle and foot.

11. 1. Onchidium *celticum*.—Oblong mantle thick, coriaceous, rather shining, covered with short thick rounded tubercles, surrounded with smaller ones; foot oblong.

Onchidium celticum. *Cuvier* (?); *Couch*; *Forbes and Hanley*, iv. 3. t. F F F. f. 6.

Inhab. Cornwall, on rock at West Comb in Sandlevel Bay (*J. Couch*).

The edge of the mantle considerably exceeds the foot; the under side of this edge minutely granulated; foot pale yellowish.

"Jaws none; tongue broad, and furnished with upwards of seventy transverse rows of blunt slightly curved teeth, each row containing 108 teeth, and divided by a minute central tooth of a triangular form bearing a single blunt spine. The reproductive organs are in the same individual. The male organ is

placed at the right side of the head, while the other parts are situated at the posterior extremity of the body; they are nevertheless connected by a long slender duct buried in the muscles at the side of the foot; the vent is distinct from the lung."—*Hancock.*

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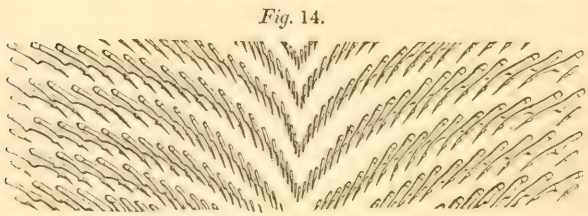
### Sub-order II. *GEOPHILA.*

Eyes at the apex of elongated cylindrical peduncles; tentacles cylindrical, shorter, and lower down than the eye peduncle, sometimes very small or wanting; the two orifices of the organs of generation confounded in the same external orifice; operculum none. Terrestrial.

Sub-division 1. *Lumbricivora.*—Mouth proboscis-shaped; jaws none; teeth numerous, slender, conical, pinlike, distant (fig. 14.); head, tentacles,

*Fig.* 14.



Teeth of *Testacellus haliotideus.*

and eye peduncle retractile under the skin. Carnivorous, worm-eating.

### Fam. 2. TESTACELLIDÆ.

Foot without any subcaudal gland; teeth slender;

the eyes rather below the acute tip of the eye peduncle.

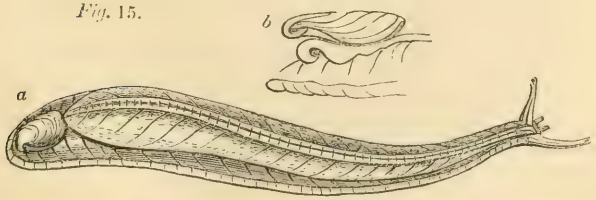
The only English genus of this family has the shell and spiral body of the animal very slightly developed. In *Helicophanta* it is more developed, like a *Vitrina* or *Streptaxis;* and in *Oleacina* it is sufficiently large to allow the animal to contract into it as in *Helix* and *Achatina*, with which they hitherto have been confounded.

* *Body with two longitudinal grooves; lips cylindrical, retractile.* (Testacellina.)

1. TESTACELLUS. (Testacelle.)

Body elongate, tapering in front, with two diverging grooves from the front of the mantle, extending to the head; mantle small, covered with an ear-shaped shell, with a very short spire, which is placed on the hinder part of the body. The mouth of the shell is very large, the outer lip thin, with a slight notch at the hinder end. Shell ear-shaped, on the hinder part of the body (figs. 15, 16.).

*Fig.* 15.




*a*, *Testacellus haliotideus*, walking, expanded.
*b*, shell elevated from end of body.

Faure Biguet, who first discovered the animal, called it *Testacellus;* Draparnaud and Cuvier have changed the name to *Testacella.*

The animals, according to the observations of M. Férussac, have a peculiar mantle (or rather appendage of the mantle), which is simply gelatinous, contractile, and habitually hidden under the shell, divided into several lobes, and susceptible of an extraordinary development, so as to envelope the whole of the contracted body of the animal, and thus protect it from extreme drought.

The animals live for the greater part of their life in holes under ground, only coming to the surface to change their locality; and they remain buried during the cold or very dry weather. It is this power of protecting themselves from the effect of sudden changes of temperature, there is little doubt, that has allowed them to adapt themselves with such facility to our climate.

They deposit their eggs under ground; these are oblong, large and covered with a thick elastic coat, and burst when put into a warm place.

12. 1. TESTACELLUS *haliotideus.* Ear-shaped Testacelle.—Shell roundish-oval, with the outer lip dilated, and the pillar flat and broad, and scarcely reflected outwardly. The lateral grooves of the body close together in the front of the shell. Tongue with 20 longitudinal series of teeth. (t. 3. fig. 19, 20.)

Testacellus haliotideus. *Faure, Big. Bul. Soc. Phil.* 1802, 98.; *Férussac, Hist.* t. 8. f. 5. 9 ; *Sowerby, Gen.* f. 1, 2.; *Moq.*

*Tand. Moll. Franc.* ii. 39. t. 5. — Testacella haliotidea. *Drap.* t. 8. fig. 44, 45.; *Forbes and Hanley, B. M.* iv. 26. t. G G G. f. 1. — Testacella scutulum. *Sow. Gen.* f. 3. 3. ; *F. D. Mag. N. Hist.* vii. 229. f. 41. ; *Lukis, Mag. N. H.* vii. 224. f. 29. — Testacella europæa. *Roissy. Buff.* v. 252 — Testacellus europeus. *Montf. C. S.* ii. 95. fig. — Testacella Galliæ. *Oken, Lehrb. N.* iii. 212. t. 9. f. 8. 1815. — Testacellus Medii Templi. *Tapping, Zoologist*, xiv. 1856, 5099. — Testacella Companyonii. *Dupuy. Moll. Franc.* i. 47. t. 1. f. 3. — Testacellus bisulcatus. *Risso, Eur. Mer.* iv. 58. — Testacella bisulcata. *Dupuy.* l. c. 44. t. 1. f. 2.

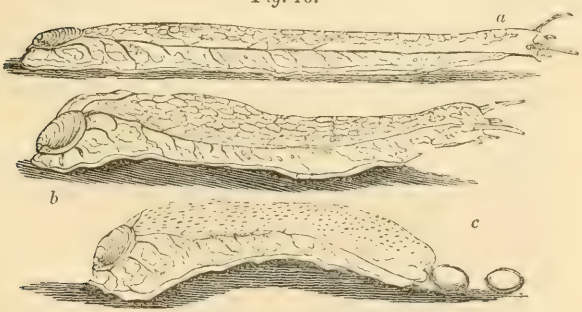
Inhab. France. The "*Coquillade*" was recorded as living near Dieppe by M. Dugul, in 1740. Naturalised in gardens.

Animal yellowish, reddish, or grey, sometimes spotted on the sides beneath; tentacles cylindrical.

The shell is broad in proportion to its length, and the pillar, near the upper end, is broad and nearly flat.

This animal is common in the island of Guernsey,

*Fig.* 16.




*Testacellus haliotideus.*
*c*, head retracted when depositing the eggs.

where it was first observed in the garden of Mr. Lukis, in 1801. The late Mr. Sowerby afterwards

found it in a garden at Lambeth. When the animal deposits its eggs, the head and tentacles are drawn in. See fig. 16. *a*, *b*, *c*, from *Mag. Nat. Hist.* vii. 226. f. 39., exhibiting the animal in its different positions.

In winter, they bury themselves from one to two feet deep in the earth, and are most above the surface from August to November. They chiefly live on worms, and sometimes will attack slugs and smaller specimens of their own species; shells of their own kind being sometimes found in their stomach.

The *Testacella scutulum* of Sowerby and *Testacellus Medii Templi* of Mr. Tapping are very slight varieties of the common species.

*Testacellus Mangei* has a more developed shell, the lateral grooves far apart in front of the shell, and only 15 longitudinal series of teeth on the tongue.

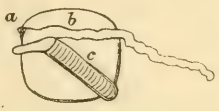
Sub-division 2. *Phyllivora.* — Mouth simple; jaws distinct, horny; teeth numerous, four-sided, close together, side by side, with a reflexed toothed apex; head tentacle and eye peduncles retractile under the skin. Eyes at the apex of the club of the peduncle. Herbivorous.

The following account, of the teeth is abridged from an elaborate paper by Mr. William Thompson in *Ann. and Mag. N. Hist.* 51. 86.; from which also the figures are taken: —

"The tongue of the *Phyllivora*, generally, is a thin expansible membrane, two thirds or three

fourths of which is rolled into a tube, fig. 17. *c*; the posterior end of this tube is closed, its anterior extremity expanded into a flattened or spoon-shaped form, which plays against the edge of the horny upper jaw, fig. 17. *a*, thus acting more in the capacity of an under jaw than a true tongue.*

*Fig.* 17.




Mouth mass of *Helix*.

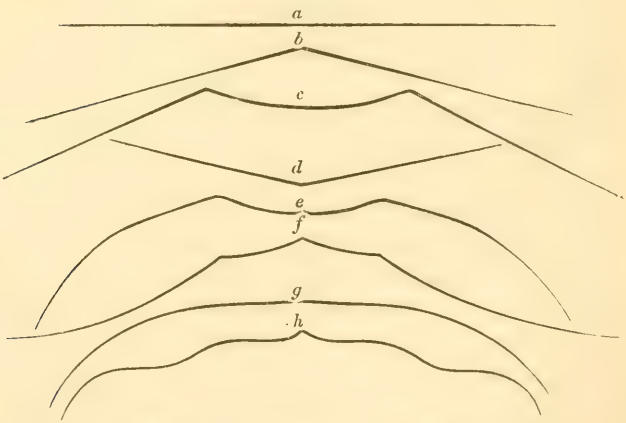
" It is enclosed in the muscular head of the animal, and is connected with the œsophagus, f. 17. *b*, at the anterior end of the tube, the extended upper portion of the œsophagus forming the roof of the mouth, while the expanded surface of the tongue covers the lower part of the mouth. The head is usually globular or nearly so, sometimes slightly attenuated backwards. From the junction of the tube of the œsophagus and tongue, the former passes backwards through the head, and leaves it at its upper part behind (sometimes coming out almost at the top of the head), while the tongue takes at once a downward and backward direction, and protrudes its closed end distinctly at the lower part of the head.

" If the tubular part of the tongue be laid open and expanded (when it always proves of the same width as the naturally expanded portion), it will be found to be covered on its upper surface with a vast number of plates, each carrying one or more tubercles which do not stand perpendicularly to the

* Lister and Adanson regarded the hard lingual membrane of *Limax* and *Helix* as a second or lower jaw. Adanson mentions the teeth, and compared the "jaw" to an *étrille*. Swammerdam called the tongue a cartilage.

surface of the plates, but are abruptly curved posteriorly, so that the apices of the projection invariably point towards the closed end of the tongue, f. 19. and 20. These teeth are distributed in rows all over the membrane, and are closely packed together. The longitudinal rows always consist of straight lines, but the transverse rows are variously curved, often bow-shaped, sometimes angular, rarely straight (fig. 18.).

*Fig.* 18.




*Direction of the cross series of Teeth in*

*a*, Planorbis contortus.
*b*, Ancylus fluviatilis.
*c*, Zonites radiatulus.
*d*, Achatina acicula.
*e*, Zua lubrica.
*f*, Vitrina pellucida.
*g*, Limax carinatus.
*h*, Helix obvoluta.

"The degree of curvature of the transverse row, and the variations which the curves show (being sometimes composed of arcs of circles, while at other times they are made up of short straight lines

lying in different directions), appear to influence the form of the teeth.

"Of the rows taken longitudinally I need not say much, it being more easy to explain the variations in the teeth when the rows are regarded transversely. Suffice it to mention that in the centre of the membrane there is a longitudinal row of teeth of different form to any of the rest (called a *rachis* by Loven);" being, in fact, the symmetrical normal tooth from which all the others more or less symmetrically diverge as the longitudinal series are placed farther and farther from the central one.

"From reference to an ideal vertical section of a plate with its tubercle (fig. 19.), it will be evident that on viewing the whole vertically (fig. 20.) through the microscope (the object being almost transparent), three outlines will generally be seen, that of the *plate*, that of the attachment of the tubercle to the plate, which I shall refer to as the *base*, and that of the free points of the tubercle, which I shall speak of as the *apex;* the *teeth* will therefore be regarded as the plate and tubercle combined.

*Fig.* 19.

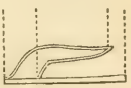
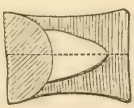


*Fig.* 20.



"The central plate and its tubercle differ from all the others on this membrane in being symmetrical. The plate is of a subquadrangular form, often somewhat longer than broad, having its sides slightly hollowed out, and its ends nearly straight (*Limax*, fig. 21.), or with its anterior end (that nearest the

base of the tubercle) somewhat bow-shaped, in which case this part overlaps the posterior straight edge of

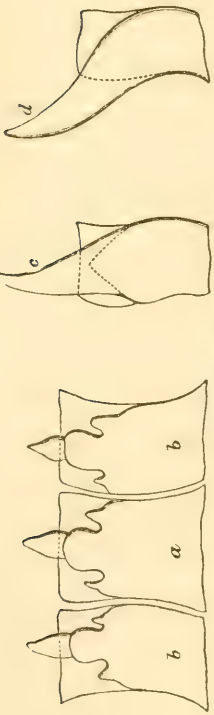



*Fig.* 21. *Limax carinatus.*
*a*, central ; *b*, first ; *c*, intermediate ; *d*, outer lateral tooth.

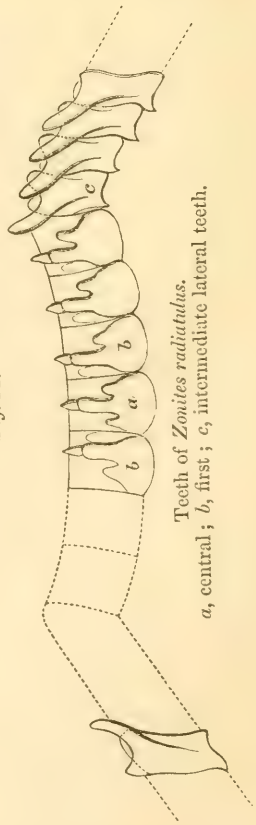


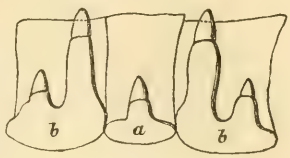

*Fig.* 22. Teeth of *Zonites radiatulus*.
*a*, central ; *b*, first ; *c*, intermediate lateral teeth.

the plate in front of it (*Zonites radiatulus*, fig. 22.). In some it is nearly square (*Zonites*), while in others

it presents the form of an inverted tapering triangle, with a rounded apex (*Amphipeplea*).

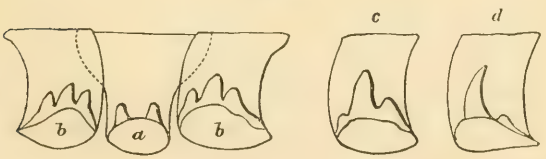
" The form of the tubercle on the central plate is subject to much greater variation than its plate. Sometimes the tubercle is very large and attached to nearly the whole surface of the plate, leaving but a small free apex (*Limax*, fig. 21.). In other species the tubercle is small, and attached by its base to the anterior portion of the plate (*Zua*, fig. 23. *a*). In another genus (*Planorbis*) we find that the tubercle is small, and has two apices (fig. 24. *a*).

*Fig.* 23.




Teeth of *Zua lubrica*.
*a*, central; *b*, first lateral tooth.

*Fig.* 24.




Teeth of *Planorbis carinatus*.
*a*, central; *b*, first; *c*, intermediate; *d*, outer lateral tooth.

The apex in some few instances projects beyond the edge of the plate (fig. 21. *a*.), and consequently lies above the base of the tooth next beyond it; but, in the majority of cases, the apex of the central tubercle does not project over the edge of its plate (fig. 21. *a*).

" The lateral plates not only differ from the cen-

tral one in form, but also from each other as they approach the edge of the membrane. The general form is subquadrilateral, the anterior and posterior edges being subject to the same variations as those described with reference to the central plate, while the inner edge is always more or less convex, and the outer edge concave. In those species where the curve of the horizontal row is considerable, the plates as they approach the edge get narrower, and in these it is not unusual for them also to assume somewhat an S form on the one side, and its reverse on the other. In others, however, the lateral plates become gradually broader, and eventually twice as broad as the primary lateral plates.

" The lateral tubercles vary nearly as much in the same individual as they do in different species.

" If an ideal line be drawn longitudinally through the central tubercle, so as to divide it equally, it will be found that the two halves are precisely similar (fig. 20.), — but such is not the case with any of the lateral tubercles, those lateral tubercles which are nearest to the central tubercles are always more similar to it in general form than those at the edges, — indeed, that the tubercles become more unlike the central tubercle as their position is nearer to the edge of the membrane — the lateral tubercles, indeed, are merely modifications of the forms of the central tubercle, — and that these modifications are effected by the *suppression* of the prominence on the *inner* side of each lateral tubercle, and the simultaneous *increase* of the corresponding part of the *outer* side.

" In *Limax carinatus*, and some allied species, we have this clearly exemplified, the changes from the typical form into that at the edge being very gradual, and showing every possible connecting link, fig. 21. *a—d.* But this gradual progression is far from being the case in all species. For example, a sudden and abrupt change in form is to be seen in the fourth lateral tubercle of *Zonites radiatulus*, fig. 22. *c.* This sudden change of form is owing to the *absence* of the connecting links, which a reference to the progressive alteration in other species will readily supply. Wherever a straight transverse line is observable in the arrangement of the lateral teeth, all the teeth in that line are similarly formed, whether the right or left laterals are in the same line, as in *Planorbis contortus*, fig. 18. *a.*, or divaricate from each other at the central tooth upwards, as in *Achatina acicula*, fig. 18. *d.*, or downwards, as in *Ancylus fluviatilis*, fig. 18. *b.* Wherever the curve presents great angularity, as in *Zonites radiatulus*, fig. 18. *c.*, there we find a sudden change in the form of the teeth, while in like manner a gradual curve (*Limax carinatus*, fig. 18. *g.*) is the result of a gradually progressive change in the form of the teeth, the degree of deviation from a straight line being exactly in proportion to the amount of change which takes place between the form of the central and edge teeth.

" The following table gives some idea of the number of teeth in a transverse or horizontal row, of a few species, together with the number of rows upon the tongue, and the whole number of teeth on that organ.

| | Number of transverse rows. | Number of teeth in row. | Number of teeth on tongue. |
|---|---|---|---|
| Arion ater - - - | 160 | 110 | 17,600 |
| Limax maximus - - | 160 | 180 | 28,800 |
| —— carinatus - - | 80 | 100 | 8,000 |
| Vitrinus pellucidus - - | 100 | 75 | 7,500 |
| Helix aspersa - - | 135 | 105 | 14,175 |
| —— nemoralis - - | 135 | 100 | 13,500 |
| —— pomatia - - | 140 | 150 | 21,000 |
| —— obvoluta - - | 170 | 90 | 15,300 |
| —— lapicida - - | 150 | 80 | 12,000 |
| —— pulchella - - | 65 | 30 | 1,950 |
| —— cantiana - - | 125 | 80 | 10,000 |
| —— concinna - - | 100 | 50 | 5,000 |
| —— pisana - - | 120 | 70 | 8,400 |
| —— caperata - - | 100 | 45 | 4,500 |
| —— cricetorum - - | 115 | 60 | 6,900 |
| Zonites alliarius - - | 45 | 25 | 1,125 |
| —— cellarius - - | 35 | 27 | 945 |
| —— nitidulus - - | 55 | 65 | 3,575 |
| Succinea putris - - | 50 | 65 | 3,250 |
| Balanus obscurus - - | 120 | 55 | 6,600 |
| —— acutus - - | 100 | 37 | 3,700 |
| Zua lubrica - - | 80 | 40 | 3,200 |
| Pupa juniperi - - | 100 | 40 | 4,000 |
| Balea perversa - - | 130 | 40 | 5,200 |
| Clausilia bidens - - | 120 | 50 | 6,000 |
| —— nigricans - - | 90 | 40 | 3,600 |
| Limneus stagnalis - - | 110 | 110 | 12,100 |
| Ancylus fluviatilis - - | 120 | 75 | 9,000 |
| Velletia lacustris - - | 75 | 40 | 3,000 |

"Since *Limax maximus* heads the list with 28,000 teeth, and *Helix pomatia* follows with 21,000, it might be conjectured, perhaps, that size had some influence in the matter; but we find *Helix aspersa* and *H. nemoralis* possessing nearly the same number, while *Helix obvoluta* — a shell very little, if at all, larger than *Zonites cellarius* — possesses more than fifteen times the number of teeth.

"With reference to the actual size of the teeth, it will be convenient to take the 10,000th of an inch as the measuring standard; and therefore the numbers that I shall now use in giving the dimensions of the teeth are to be regarded as so many 10,000ths of an inch.

"In *Arion ater* the central and their neighbouring plates are 25 long by 15 wide. In *Limax maximus* they are 20 long by $11\frac{1}{2}$ wide. In *Bulimus obscurus* the length of this plate is 7, while the average length of all in the row is $4\frac{1}{2}$. In *Zua lubrica* the length is $5\frac{1}{2}$, and the average breadth $4\frac{1}{2}$. In *Clausilia nigricans* the length is $4\frac{1}{2}$, and the average breadth $3\frac{2}{3}$. The primary lateral plates of *Limneus stagnalis* is 22 long by $12\frac{2}{3}$ wide. In *Amphipeplea glutinosa* the corresponding plates are $11\frac{1}{2}$ long and 10 wide, which happens to be precisely the size of the primary teeth of plates in *Planorbis corneus*.

"The teeth of *Arionidæ and Limacidæ* are much alike, and differ from *Helicidæ* in having a long projecting single apex to the edge teeth.

"The *Helicidæ*, on the other hand, show a marked disposition to increase the number of apices by bifurcation as they approach the edge.

"*Arion ater*, *Limax maximus*, and *L. carinatus*, *Vitrina pellucida*, *Zonites alliarius*, *Z. cellarius*, *Z. nitidulus*, and *Z. radiatulus* have the edge teeth aculeate; *Helix fulva*, *H. aspera*, *H. pomatia*, *Zonites rotundatus*, &c. have the edge teeth serrate."—*Thompson.*

The jaw in *Limaces* and *Helices* is single, in the upper part of the buccal cavity, and is more analo-

gous to the lateral jaws of *Limnea* than to the upper of the two jaws of *Neritina*, and appears to be formed of the fusion of these jaws; for *Planorbis corneus* has the rudimentary lateral jaws of *Lymnea;* in all the other species the jaws are reduced to a single strongly arched one, as if formed by the fusion of the three into one. — *Moquin Tandon*, 33.

M. Moquin Tandon proposes to characterise the genera by the form of the upper jaws.

In *Helix* the jaw is lunate, with three or more strong ribs across it, which end in well-marked marginal teeth (fig. 25.).

In *Arion*, *Bulimus*, *Clausilia*, *Pupa*, and *Vertigo*, the front of the jaw is more or less strongly striated

*Fig.* 25.

Jaw of *Helix pomatia*, enlarged.

*Fig.* 26.

Jaws of *Arion hortensis*, magnified.

*Fig.* 27.

Jaw of *Limax gagates*, magnified.

across, and slightly denticulated and crenated on the lower edge (fig. 26.).

In *Limax*, *Zonites*, *Vitrina*, and *Succinea*, the jaw is smooth, without any ribs, striæ, or teeth, but has a more or less prominent beak in the middle of its lower edge (fig. 27.).

These characters appear to be permanent, as far as they have been observed, in the more restricted genera, as *Vitrina*, *Succinea*, *Clausilia*, *Pupa*, *Vertigo*, *Limax*, and *Arion;* but there are many exceptions even amongst the European species of the

genera or subgenera of *Zonites*, *Helix*, and *Bulimus*: thus *Helix elegans* has the jaws of a *Bulimus*, *Bulimus acutus* of a *Helix*, and *Helix candidissima* of a *Zonites*. M. Tandon proposed to move these species to those genera for these reasons; but, if his figures of the jaws of the different kinds are examined, it will be found that there are only a few of the exceptional species.

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## Fam. 1. ARIONIDÆ.

Head and tentacles retractile* into the skin, which covers them as a sheath, being drawn into the cavity of the body; the end of their tail is as it were truncated, and furnished with a transverse lunate, or an erect longitudinal, gland on its upper edge; the respiratory cavity is in the front of the body, with the hole in the front of the mantle's edge; and the orifice of the generative organs is placed on the right side, near, or immediately under, the respiratory aperture (fig. 28.). The shell is presented in very different degrees of development in the different genera,—it is very rudimentary in the only English one.

### 1. ARION *Férus.* (Land Soles.)

Body elongate, lanceolate, united its whole length to the foot; back keeled, attenuated behind;

* Ehrenberg proposes to call the tentacles of snails *tentacula*, and those of pond snails, which do not bear eyes, *vibracula*.

mantle shield-like, simple, anteriorly ovate, granular; the orifice of the generative organs is immediately under the respiratory aperture; subcaudal gland transverse, horizontal. The jaw narrow, striated in front, and crenulated on the edge (fig. 26.). Shell distinct, oblong, sometimes only spongy, or only a few granules in the substance of the mantle.

The eggs separate, covered with a hard calcareous shell. They lay about 70 or 100. They vary from twenty-five to forty days in hatching, and the animals attain their full growth in a year, but they begin to deposit their eggs a month or two before that period.

a. *Shell none, or hemispherical and spongy.* (Lochea.)

13. 1. Arion *ater.* Black Arion.—Tentacles black; the side of the foot marked with transverse black lines; body with interrupted longitudinal grooves; shield minutely granular; shell spongy, hemispherical (fig. 28.).

*Fig.* 28.

*Arion ater.*

Limax ater. *Linn. Faun. Suec.* 507.; *Müller, Verm.* 2.; *Drap.* 122. t. 9. f. 3—6.; *Sturm, Faun.*; *Nunneley, Trans. Phil. Soc. Leeds*, 46. t. 1. f. 1. t. 2. f. 1. t. 3. f. 1. 3—6. t. 4, & 5. f. 1. — Limax rufus. *Linn. F. Suec.* 507.; *Razoum.*; *Drap.*

123. t. 9. f. 6.; *Sturm*, *Fauna*, t. — Limax succineus. *Müller*, *Verm.* 7. 203. — Limax luteus. *Razoum.* — Limax marginellus. *Schrank.* — Arion empiricorum. *Férus. Hist. Moll.* 60. 17. t. 1, 2, 3.; *Alder*, *Mag. Zool. and Bot.* ii. 105. *Leach. Syn. Moll.* 47. t. 8. f. 1, 2.; *Forbes and Hanley*, *B. M.* iv. 7. t. D. D. D. f. 4. — Limax subfuscus. *Lister*, *A. Ang.* t. 2. f. 1.; *Drap. H.* 125. — Arion subfuscus. *Férussac.* — Arion rufus. A. albus and subfuscus. *Moq. Tandon*, *Moll. Franc.* ii. 10. t. 1. f. 1—27. — Limax albus. *Linn. S. N.* i. 1081. — Arion albus. *Feruss. Moll.* i. 64. t. 2. f. 3. — Arion virescens. *Mill. Moll. Main.* 11. 1854.

Var. emitting a yellow mucus. — Arion flavus. *Férussac*, *H. Moll. Supp.* 96. n. 7.; *Alder*, *Cat. North.* 30.; *Forbes and Hanley*, *B. M.* iv. 9. 287. t. F F F. f. 2. — Limax flavus. *Müller*, *Verm.* ii. 10.

Living under damp leaves, only coming to the surface in damp weather. The young specimens of the black variety are dull brown, with yellowish sides.

They vary greatly in colour, from black to brownish rufous, yellow, and yellowish white; the keel is sometimes greenish; the edge of the foot is generally the same colour as the back, but in some of the dark varieties it is scarlet or yellowish, it is always lined with black. Some naturalists have considered these varieties as species; hence the number of synonyma.

Mr. Nunneley believes that the variation of colour is "occasioned by habitation and food, as in fields it is nearly always of a deep black, while in gardens, where the food is more various, it is found of various colours." This does not agree with my experience, for I have found them of very various colours in woods, and under exactly similar circumstances, and at the same period.

The calcareous particles, particularly of the red

variety, sometimes form an irregular sub-hemispherical spongy shell.

It has a great geographical range, being found equally in Ireland and Norway, and Italy and Spain. It deposits its bluish eggs in a cluster, in May, at the roots of plants.

It feeds on dead and living vegetables, and sometimes, according to Mr. Power (*Linn. Trans.* ix. 323.), on dead earth-worms.

The country people consider the appearance of this slug as an indication of approaching rain; but this is rather to be accounted for by the moisture of the ground and of the plants. It is seldom, indeed, to be observed abroad during dry weather, for this would deprive the body of the moisture which is requisite for its existence. (*Bingley.*)

A black slug (*Arion ater*), placed in a box of sand taken fresh from the sea, after emitting a quantity of mucus, became reconciled to his situation, and commenced eating the sand to extract the organic matter. The fæces were at first of a green vegetable colour, but were at length entirely composed of pure sand, the grains united together into their usual form by a little mucus. (*Gray, Ann. and Mag. N. H.* ii. 310. 1829.)

b. *Shell imperfect, rugose, rarely wanting.* (Prolepis.)

14. 2. Arion *hortensis.* Garden Arion. — Black, with grey longitudinal streaks; edge of the foot orange; shell imperfect, rugose, or wanting. (t. 1. f. 16.)

Arion hortensis. *Férus. Hist. Moll.* 6. 5. t. 11. f. 4—6. viii. *a.* f. 2, 3, 4., *Tabl. Syst.* 18.; *Gray, Med. Rep.* 1821; *Leach, Syn. Moll.* 49.; *Forbes and Hanley, B. M.* iv. 10. t. F. F. f. 1.; *Gray, Cat. B. M.* 56. — Limacella concava. *Brard, Hist.* 121. (Shell.) — Limacellus variegatus. *Turton, Man.* ed. 1. 25. t. 3. f. 16. (Shell.) — Limax subfuscus. *Pfeiffer, Syst. Ind.* 4. 20. (?) — Limax hortensis. *Blainv.*; *Gratel. Moll. Dax.* 55. f. 4.; *Michelen*, 6. Var. 2. with a black streak on each side. — Limax fasciatus. *Nilson, Faun. Suec.* 3. — Arion circumscriptus. *Johnst. Edinb. Phil. Journ.* 1828, v. 77. — Arion hortensis, var. β. *Alder, Mag. Zool. and Bot.* iii. 105. — Arion (Prolepis) fuscus. *Moq. Tandon, Moll. Franc.* ii. 14. t. 1. f. 28—30.

Inhab. woods, hedges, and gardens. Gray, 1817.

The variety is greyish, spotted with black, and with a black fascia round the shield and body; the respiratory hole is anterior. The young is yellow or white, with black head and tentacles.

Common in gardens near London, called the April Slug. Eggs phosphorescent.

M. Tandon describes 11 varieties.

## 2. Geomalacus.

Body rather depressed; shield granular; back rounded, convex, not keeled; subcaudal gland lunate, horizontal; respiratory aperture rather in front of the middle of the lower edge of the shield; foot divided into three equal longitudinal bands.

15. 1. Geomalacus *maculosus.* Spotted Irish Slug. — Intense black beneath, pale white back and shield, with numerous subequal yellow spots, generally more numerous in a line on each side of the body.

Geomalacus maculosus. *Allman, Ann. & Mag. N. H.* xvii. 297. t. 2.; *Mr. Gray, Mollusca*, t. 280. f. 1.; *Forbes and Hanley, B. Moll.* iv. 12. t. F F F. f. 5.

West Ireland, Kerry. W. Andrew, Esq., 1842.

The subcaudal gland is small, and scarcely to be distinguished in specimens in spirits. These animals are difficult to keep alive in confinement.

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## Fam. 2. HELICIDÆ.

Head and tentacles retractile, like the former; but the end of the tail is tapering, and destitute of any gland. The pulmonary cavity is generally in the front of the body; the respiratory hole is on the hinder part of its edge; and the orifice of the generative organs is placed near the hinder outer base of the right tentacle. The eyes are on the top of the clubbed eye peduncle. The tentacles are rarely wanting.

This family contains more than half of the British land and fresh-water shells, that is, 72 out of 128 species. It has been divided into several genera, and there are many more exotic ones.

Many Helices begin to reproduce before they reach their full growth.

The eggs of most of the Helices of *Bulimus obscurus*, *Clausilia nigricans*, and *Balea* are opaque or opaline, and isolated. Those of *Helix virgata* are transparent. The eggs of *H. pulchella* are united together into the form of a cup, often 3 or 4 times as large as the animal and its shell. *Vitrina pellucida*

and *Succinea* also unite their hyaline eggs into a mass with some gelatinous matter. The eggs of *Bulimus obscurus* are large, roundish-oval; those of *Clausilia nigricans* are ovoid, and very large for the size of the animal, being nearly as large as the mouth of the shells. Those of *Balea* are large and globular.

The following table is formed from M. Bouchard's observations. The first column exhibits the time of laying, No. 1. standing for January; the second, the number of eggs laid at one time; the third, the number of days hatching; the fourth, the number of months before the animal arrives at its adult age.

| | 1. | 2. | 3. | 4. |
|---|---|---|---|---|
| Helix virgata | 9—10 | 40— 60 | 15—20 | 18—24 |
| —— pomatia | 6— 9 | 60— 80 | 20—30 | 13 |
| —— arbustorum | 7— 9 | 50 | 15—20 | 15—16 |
| —— aspersa | 5—10 | 100—110 | 15—30 | 13 |
| —— nemoralis | 5—10 | 50— 80 | 15—20 | 11—13 |
| —— hortensis | 5—10 | 50— 80 | 15—20 | 11—13 |
| —— carthusiana | - - | 60— 80 | 13—15 | 10—11 |
| —— cantiana | 7— 8 | 60— 90 | 14—15 | 11 |
| —— fusca | 9—10 | 40— 50 | 20 | 10—12 |
| —— pulchella | 7— 9 | 10— 20 | 15—20 | 12 |
| —— hispida | 4— 9 | 40— 50 | 15 | 15—16 |
| —— rufescens | 7—10 | 40— 50 | 20—25 | 11—14 |
| —— ericetorum | 7—11 | 40— 60 | 20 | 18 |
| —— caperata | 7—10 | 35— 40 | 15—20 | 12 |
| —— rotundata | 5— 9 | 20— 30 | 13—20 | 12 |
| Zonites nitidus | 3— 9 | 30— 50 | 15—16 | 14 |
| Vitrina pellucida | 9—11 | 8— 15 | 15—20 | 8—10 |
| Succinea putris | 5— 9 | 50— 70 | 14—15 | 11—12 |
| Bulimus obscurus | 5— 9 | 12— 15 | 15 | 13 |
| Clausilia nigricans | - - | 10— 12 | 18—20 | 22—24 |
| Balea fragilis | 7— 9 | 12— 15 | 15—20 | 12 |

They have been distributed into sections in the following manner:

§ 1. *Scutifera.* — Body elongate, attached the whole length of the foot; mantle shield-like, with a small internal shell. (*Limacina.*)

1. *Limax* (fig. 29.).

§ 2. *Cochleophora.* — Body more or less spiral, prominent on the (middle generally) upper surface of the foot, and covered with a more or less spiral shell. Sometimes partly hidden by the reflexed part of the produced edge of the mantle.

* *Mantle produced in front, and partly extended over the shell.* (Vitrinina.)

2. *Vitrina.* Shell depressed, polished; mouth semilunar, large; peristome thin.

** *Mantle enclosed, not produced in front.*

3. *Zonites.* Shell depressed, polished; mouth semilunar; peristome thin, acute.
4. *Helix.* Shell subglobose or depressed, striated; mouth semilunar; peristome rather thickened and reflected.
5. *Succinea.* Shell oblong, elongate; mouth very large, oblong; peristome thin.
6. *Bulimus.* Shell oblong, elongate, striated; mouth moderate, ovate, toothless.
7. *Zua.* Shell oblong, elongate, polished; mouth moderate, ovate, with a thickened internal edge.
8. *Azeca.* Shell oblong, elongate; mouth moderate, toothed, with a thickened internal edge.

9. *Achatina.* Shell turreted, elongate; mouth ovate; inner lip truncated in front; peristome thin.
10. *Pupa.* Shell cylindrical, blunt; mouth sinuous; peristome reflected.
11. *Vertigo.* Shell cylindrical, blunt; mouth toothed; peristome thickened behind.
12. *Balea.* Shell fusiform, elongate: mouth ovate, clausium none.
13. *Clausilia.* Shell fusiform, elongate; mouth toothed, with an elastic clausium.

§ 1. *Scutifera.* — Body elongate, attached the whole length of the foot.

### 1. Limax *Fér.* (Slug.)

Body elongate, lanceolate, granular, keeled behind; mantle shield-like, ovate, concentrically lined; shell internal, sub-quadrate, flat, nail-like (fig. 29.).

These animals have very much the external appearance of *Arion;* but they are destitute of the gland on the end of the tail, their mantle is marked with circular striæ instead of being granulated, and they have a different nervous system, for, according to Mr. Nunneley, the infra-œsophageal ganglion is like that of Arion, but the under side, instead "of having one transverse fissure, has two, so that it presents, on each side of the medial line, three gangliform eminences instead of two only." Jaw strong, smooth, with a strong central projection (fig. 27.).

They have generally been united with the *Arions;* but it has lately been discovered that there are animals with well-developed shells that agree with the Arions in character, as the Helices do with the Slugs; and it has therefore been thought better to separate them by the above character into two groups, rather than follow Lamarck in dividing these animals into groups, by the gradually and greatly varying form of the body.

The shells are covered with a distinct periostracum. It has generally been believed that shells which are covered with a reflexed portion, or imbedded in the mantle, are destitute of this covering; and they have been separated from other shells for this reason. But this is an error arising from the theory that the *periostracum* of shells is analogous to the scarf-skin of vertebrated animals, instead of its being merely the part, consisting almost entirely of animal matter, that is first deposited by the animal when it is about to enlarge its shell, and which forms the basis of the new part of the shell, afterwards strengthened and thickened by the addition of the chalky matter within it.

These animals sometimes suspend themselves by a kind of thread formed from the viscid secretion which covers their body; hence one of the smaller ones has been called *Limax filans*. The eggs are covered with a transparent coat, and are often united together by a membrane like a string of beads. They are laid between May and September. They are hatched in about 25 or 30 days, and the young reach their full size near the end of the year. *Limax*

*cinereus* lays about 50 or 60, and *L. agrestis* is much more prolific, as it continues laying from April to the end of November, depositing 30 to 70 eggs each time, two individuals having laid 348 eggs in that period. The young grow very rapidly. They commenced laying eggs on the 66th day of their age, when they did not reach their full size until the 92nd day.

Swammerdam (*Bib. Nat.* i. 158. t. 8.) gives some details of the anatomy of one of the species; but recently Mr. Nunneley, in the *Leeds Transactions*, has given an excellent paper on the comparative anatomy of three of the species, and has shown that there exists a considerable difference in internal organisation between them and the *Arion ater*.

I have great pleasure in referring the reader to this paper for the details, and cannot help expressing a hope that other persons residing in the country will be induced to follow Mr. Nunneley's excellent example, and give to the world similar papers on the animals in their neighbourhood.

a. *Back rounded; tail keeled; the dorsal shield marked with two orders of concentric striæ, simple, rather produced behind; shell flat.* (Limax.)

16. 1. Limax *maximus*. Spotted Slug. — Animal ash, variously spotted, with a long white acute keel; the tentacles vinous coloured, and the hinder part of the mantle produced, buckler-shaped (fig. 29.). Shell thin, flat, oblong, a little concave, with a membranaceous edge. (t. 3. f. 14.)

Limax maximus. *Linn. S. N.* t. 3. f. 6. 10. 108.; *Penn. B. Z.* iv. 41. — Limax maculatus. *Leach, MSS. Brit. Mus.*, in *Syn. Moll.* 52.; *Nunneley, Trans. Phil. Soc. Leeds*, i. 46. t. 1. f. 2., and *Anat.* — Limax maximus cinereus. *Lister, Ex. Anat.* t. 3. f. 6. 10. — Limax cinereus. *Müller, H. V.* 5.; *Drap.* 124. t. 7. f. 10.; *Sturm, Fauna*, t. 5.; *Forbes and Hanley, B. M.* iv. 15. t. D. D. D. f. 1.; *Gray, Cat. B. M.* 163. — Limax ater. *Razoum.* — Limax fasciatus. *Razoum.* Limax cinereo-niger. *Nilson*, 7.; *Wolf* in *Sturm, Fauna*, t. 6. — Limax antiquorum. *Férus. Hist.* 68. t. 4. t. 8. a. f. 1. t. 4. f. 4. (Shell.) *Leach, Syn. Moll.* 51. — Limax (eulimax) maximus. *Moq. Tand. Moll. Franc.* ii. 28. t. 4. f. 1—8. — Cochlea nuda, s. domestica. *Swam. B. Nat.* i. 158. t. 8.; *Lister, Ang.* t. 1. f. 151. — Limacella Parma. *Brard*, 110. t. 4. f. 1, 2. 9, 10. (Shell.) — Limacellus Parma. *Turton, Man.* ed. 1. t. 3. f. 14. (Shell.); *Lister, Ang.* t. 1. f. 15.

Inhab. cellars.

The skin has small rugosities placed in lines converging towards the tail. The foot is divided into three nearly equal bands.

*Fig.* 29.

*Limax maximus.*

The animal is very variable in its colour. 1. Reddish brown, with four longitudinal, black, interrupted stripes, and the shield black-spotted. 2. Brown, black-spotted, back with three yellow, and two black lines. 3. Brown, with rather darker streaks. 4. Brown, black-spotted. 5. Ash, with a black shield; and 6. Black, with a white keel: the latter is *L. cinereoniger* of Nilson.

Shell about six lines long and four broad, thin, semitransparent, yellowish-white, concave on the

inside, which is sometines sprinkled with minute crystal-like shining particles, a little convex and transversely wrinkled on the outside; with the edges membranaceous; on the top, or broader extremity, is a small central prominence, or apophysis of adhesion, by which it is attached to the animal; the lower extremity very thin and rounded.

When irritated, they dilate their shields. Their eggs are white, and deposited in spring under stones &c.

These animals (especially the larger slug) are often infested with mites, which were discovered by Réaumur, in the *Mém. Acad. des Sciences*, 1710, and called by Gmelin *Acarus Limacum*. They have been well described, with some interesting details of their habits, by Mr. Jenyns, under the name of *Philodromus Limacum*, in the *Mag. Nat. Hist.* iv. 538. f. 109.

b. *Back rounded; tail keeled; shield short, not produced behind, with a single order of concentric striæ; respiratory hole subcentral or posterior.* (Eulimax.)

17. 2. LIMAX *flavus*. Yellow Slug. — Yellowish, tessellated with brown; tentacles bluish; the hinder part of the mantle rounded; shell thin, concave, mammillated externally at its posterior extremity. (t. 3. f. 15.)

Limax flavus. *Linn. Fauna Suec.* 363.; *Nilson, Moll. Suec.* 5.; *Clark, Ann. and Mag. N. H.* xii. 338. t. 11. f. 11, 12.; *Forbes and Hanley, B. M.* iv. 19. t. E. E. E. f. 1. — Limax variegatus. *Drap. Hist. Moll.* 127.; *Fér. Prod* 21, *Hist.* 71. t. 6. f. 1—6.; *Numeley*, l. c. 47. t. 1. f. 3.; *Leach, Syn. Moll.* 52. — Yellow slug. *Penn, Brit. Zool.* iv. 41., from

*Lister.* — Limax succino colore. *List. Conch.* t. 101. f. 6. — Limacella unguiculus. *Brard*, 115. t. 4. f. 3, 4. 12. 14. (Shell.) Limacellus variegatus. *Turton*, *Man.* ed. 1. t. 3. f. 15. (Shell.) as L. unguiculus.

Inhab. cellars and damp places in and near London, Plymouth, and Oxford.

In spirits, it is dark olive, mantle and back yellow-spotted, sides rather paler; the number and size of the yellow spots vary in the different specimens; the young have sometimes a yellowish dorsal streak; the end of the tail only is keeled, by which it is known from *Limax maximus;* and the central band of the foot is generally rather narrower than the side ones. The shell is very like that of *Limax maximus*, but it is smaller, and the front edge is generally more rounded.

Lister did not mark this species as English, but this was probably an oversight of the engraver.

When touched, it becomes covered with a white mucus. It has the power of forming a thread, by which it suspends itself from trees, &c. This fact was first noticed by Lister (*Anim. Ang.* iii.), and since by Dr. Latham and others (*Linn. Trans.* i. 182. and iv. 85.).

M. Bouillet and M. Morelet observe that some slugs, as *L. flavus*, lose their colour if they are tormented or kept in confinement; thus *L. flavus* passes from bright yellow to dull olive green.

18. 3. Limax *agrestis* Linn. Milky Slug.—Reddish or grey, often spotted with brown; body furrowed with interrupted lines, with a short oblique keel; the mantle large, ovate, with

series of circular lines, rounded behind; shell small, oval, rather concave, thin, wrinkled, brittle with a nipple. (t. 3. f. 6.)

Limax (Eulimax) agrestis. *Moq. Tandon, Moll. Fran.* ii. 22. t. 2. f. 18. 22. t. 3. f. 1, 2. — Limax reticulatus. *Müller, Verm.* 207. — Limax cinereus alter. *Lister, Anim. Ang.* 130. t. 2. f. 16. — Limax cinereus immaculatus. *Linn. F. Suec.* 366. — Limax reticulatus. *Müller, Verm. H.* 10. — Limax sylvaticus. *Drap. Hist.* 126. t. 9. f. 11. (not 10.) — Limax agrestis. *Linn. S. N.* 1. 1082.; *Müller, Verm.* 204.; *Nunneley*, l. c. t. 1. f. 4.; *Férussac, Moll.* 73.; *Leach, Syn. Moll.* 54.; *Forbes and Hanley, B. M.* iv. 13. t. D D D. f. 2.; *Clark, Ann. and Mag. N. H.* xii. 338. t. 12. f. 13. t. 10. f. — Limax filans. *Hoy, Linn. Trans.; List. Ang.* t. 3. f. 16. — (Shell.) Limacella obliqua. *Brard*, 118. t. 4. f. 5, 6. 13, 14. 17. — Limacellus obliquus. *Turt. Man.* 26. t. 3. f. 6., as variegatus.

Inhab. fields. (*Lister.*)

Varies greatly in size and colour, from white to pale reddish, and from grey to blackish, but is easily distinguished by its short keel, which is always placed obliquely. When irritated, it pours out a milky white mucus, which leaves a white streak when it is dry.

Mr. Forbes figures a monstrosity with the two upper eye-bearing tentacles united into a single conical prominence. (*Brit. Moll.* t. I. I. I. f. 4.)

M. Recluz has observed that *Limax rufus* and *L. agrestis* often attack not only *Boletus edulis*, but also *Agaricus muscarius*, a very poisonous mushroom, and the *Agaricus phalloides*, a species still more formidable from the rapidity of its deadly effects, without any evil effect; at the same time they seem to avoid *Boletus luridus*, which has the faculty of becoming blue when the fragments are

exposed to the light. (*Ann. and Mag. N. H.* viii. 73. 1842.)

19. 4. LIMAX *arboreum*. Tree Slug. — Cinereous, striped and mottled, with dusky back rounded, carinated at the tail; shield wrinkled, pointed behind; upper tentacles short; shell oval, thin, slightly concave. (*Clark*, t. 10. f. 6.) Mucus colourless.

Limax flavescens. *Clark, Ann. and Mag. N. H.* vi. 204. t. 10.— Limax (Eulimax) arboreum. *Moq. Tandon, Moll. Franc.* ii. 24. — Limax arboreum. *Bouchard, Mém. Boul.* ii. 164.; *Alder, Cat. North. Moll.* 31.; *Forbes and Hanley, B. M.* iv. 17. t. E E E. f. 2.— Limax arboreus. *Clark, Ann. N. H.* xii. 334. t. 11. f. 4. 10. — Limax salicetum. *Bouillet, Cat. Moll. Auvergne*, 18. (?) — Limax marginatus. *Müller, Verm.* ii. 10. (?).; *Macgillav, Moll. Aberd.* 73. (?).; *Gray, Cat. B. M.* 168. (not *Moquin Tandon*). — Limax glaucus. *Clark, MSS.* — Limax rustica. *Millet, Mag. Zool.* 1843, *Moll.* t. 53. (?). — Limax (Amalia) marginatus. *Moq. Tand.* 21. t. 2. f. 4—17.

20. 5. LIMAX *brunneus*. Brown Slug. — Blackish brown, rather rugose, longitudinally ridged; mantle paler, yellow behind, marked with fine transverse ridges; tentacles short; neck longer than the shield.

Limax brunneus. *Drap. Tabl.* 104., *Hist.* 128.; *Fér. Tab.* 23.; *Johnst. Rep. Berw. Nat. Hist. Club*, i. 154.; *Forbes and Hanley, B. M.* iv. 20. t. F. F. F. f. 47. — (Shell.) Limacella concava. *Brard* (?).

Inhab. shady woods, and is comparatively rare in Berwickshire.

Dr Johnston observes, that this differs from every variety of *Limax agrestis* in its darker colour, its colourless mucus, in the abrupt termination of the

tail, in the position of the shield, which is nearly central when the animal is fully extended, and in the size of the shield, which is as long as the posterior half of the body; nor is there any keel on this part.

21. 6. LIMAX *tenellus*. — Yellow; back rounded, compressed near the tail; shield with fine concentric wrinkles, rounded behind. Mucus orange coloured.

Limax tenellus. *Müller, Verm.* ii. 11.; *Nilson, Moll. Suec.* 10.; *Alder, Cat. Moll. North*, 31.; *Forbes and Hanley, B. M.* iv. 21. t. F F F. f. 3. — Arion tenellus. *Ray and Drouet, Moll. Champ.*

Woods, Northumberland. (*Mr. Blacklock.*)

c. *Back keeled from the mantle; mantle granulated, short, truncated, and notched behind, with two small pores on its hinder edge; shell oval, thick, convex beneath.* (Milax, or Amalia).

22. 7. LIMAX *Sowerbii*. Keeled Slug.—Yellowish, tessellated with brown; head and tentacles black; mantle granulated and with a furrow near its margin; the ridge or keel of the back very obvious, and of an amber colour; the sides pale; shell oval, often thickened, and very convex beneath. (t. 3. f. 15.)

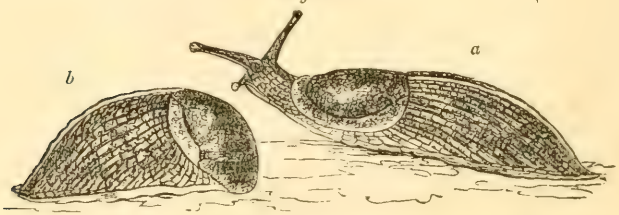
Limax Sowerbii. *Férussac, Hist. Moll.* t. 8. D. f. 7, 8.; *Denson, Loudon's Mag. N. Hist.* vi. 694. f. 120. *a. b.*; *Alder, M. Z. & B.* ii. 105.; *Clark, Ann. and Mag. N. H.* xvi. 339. t. 12. f. 14, 15.; *Alder, Cat. North.* 31.; *Forbes and Hanley, B. M.* iv. 22. t. E E E. f. 3. — Limax carinatus. *Leach, Syn. Moll.* 54. t. 8. f. 3.; *Turton, Man.* ed. 1. n. 15.; *Alder, M. Z. & B.* ii. 105.; *Thompson, Ann. N. Hist.* vi. 208. —

Limax marginatus. *Drap. Moll.* 124. t. 9. f. 7., not *Müller.* —Milax Sowerbii. *Gray, Cat. B. M.* 175. — (Shell.) Limacella unguicula. *Brard,* 116. t. 4. f. 3, 4. 11, 12. —Limacellus unguiculus. *Turton, Man.* ed. 1. t. 3. f. 15.

Inhab. gardens near London and Chelsea. (*Leach,* 1817.)

The central band of the foot is broader than the side ones; and the keel, which is very prominent, extends the whole length of the back. (See fig. 30. *a. b.* from Mr. Denson's paper.)

*Fig.* 30.




*Limax Sowerbii.*

The eggs are oval, soft, elastic, nearly $\frac{2}{10}$ of an inch long, as transparent as ground glass, but of a yellowish hue; the two coats of the egg are clouded with very minute white freckles, producing the appearance of ground glass.

They sometimes, like many of their congeners, feed on animal food, and even devour the dead remains of each other, leaving only the skin of the back; and they will also sometimes attack sickly individuals of their own species.

23. 8. Limax *gagates.* Black Slug.—Blackish grey; brown or greenish shield, rounder behind, granu-

lar or shagreened, with a deep marginal groove; back keeled the whole length from the back of the shield to the tail.

Limax gagates. *Drap. H. Moll.* 182. t. 9. f. 1, 2. *Férussac, Hist.* 75. t. 6. f. 1.; *Forbes and Hanley, B. Moll.* iv. 24. t. D D D. f. 3.; *Clark, Ann. Nat. H.* xii. — Limax cinereus. *Blainv. D., S. N.* xxv. 430. — Milax gagates. *Gray, Cat. Moll. B. M.* 174. — Limax (Amalia) gagates. *Moq. Tand. Moll. Franc.* ii. 19. t. 2. f. 1—3.

Portland Island. (*Mr. Darbyshire.*)

Inhab. Isle of Portland; S. Wales, near Tenby.

Shield olivaceous black, with paler sides; head bluish; tentacles darker, the upper deep violet; shield ample, squarish, bilobed behind, granulated, of the same colour as the rest of the body; general colour very deep olive or olivaceous black, becoming lighter on the sides, so that the margin of the foot is very pale, except near the heel, where it is darker, sole nearly white; keel somewhat darker than the rest of the body; mucus colourless.

Very likely only a darker variety of the former.

§ 2. *Cochleophora.*—Body and shell more or less spiral, prominent on the middle of foot.

* *Mantle produced, front forming a kind of anterior shield, hinder part of the edge elongate and partly covering the shell; shell polished.* (Vitrinina.)

### 2. Vitrina. (Bubble Shell.)

Animal: Body rather elongate, lanceolate; mantle subanterior, produced into a rugose shield in front, with a central spiral prominence, protected by a thin, transparent, rather depressed,

subglobular shell, which is partly covered by the back edge of the shield, and a tongue-like process of the mantle on the right side. Jaw strong, lunate, smooth, with a strong central projection; tongue broad; teeth numerous, with a single prolonged apex to the edge tooth, like *Limax*. Shell imperforated; spire depressed, of only a few whorls; mouth large, rounded, lunate; peristome thin.

*Fig.* 31.

This genus is intermediate in form between a slug and a snail, having the shield-like mantle of the one, and the globular external shell of the other genus. The shells are very like the *Zonites* in their appearance, but have a much smaller and more depressed spire, more rapidly enlarging whorls, and a much larger mouth; but they are best known by their axis being imperforated.

Nilson kept some specimens, which he had caught at the end of January, in a bell glass; and on the 19th of February he observed some eggs placed among the putrescent leaves. The eggs were oval, globose, white, subpellucid, with a central opaque spot, and placed in little tufts, consisting of eight or nine eggs. In the beginning of March the opaque spot was not increased in size, but showed signs of slow movement; and on the 21st or 22nd of March the animals were excluded. He thought, when he observed them with the microscope, that the animal bored its way through the egg-shell, forming a hole out of which first the head, and then the foot, was

produced. When first hatched, both the animal and shell were perfectly formed, but the eyes were retracted into the body; they are afterwards protruded.

M. Moquin Tandon divides the French species into those in which the animal cannot withdraw itself into its shell, as *V. elongata*, and those that can, as *V. pellucida*; the latter cover themselves with a transparent epiphragm when in a state of torpidity.

24. 1. VITRINA *pellucida*. Transparent Glass Bubble. — Shell green, depressed, hyaline and glossy; whorls three, aperture somewhat oval. (t. 3. f. 21.)

Helix pellucida. *Müller*, *Verm.* 16.; *Penn*, *B. Z.* iv. 134. (?).— Helix Draparnaudi. *Cuv. R. A.* ii. 405.; Vitrina Draparnaldi. *Leach*, *Syn. Moll.* 59. — Helix fuscescens. *Gmelin*, 3639. — Helix diaphana. *Poiret*, *Coq. Aisne*, 77. — Helix nitida jun. *Montagu*, *MSS.* — Helix limacoides. *Alten.* — Helix glaucina. *Sheppard*, *MSS.* — Helix elliptica. *Brown*, *Wern. Trans.* ii. 523. t. 24. f. 8. (1819). — Vitrina pellucida. *Drap.* 119. t. 8. f. 34—37.; *Fleming*, *Phil. Zool.* ii. t. 4. f. 1.; *Alder*, *Trans. Newcastle*, *Mag. Z. and B.* ii. 105.; *Forbes and Hanley*, *B. M.* iv. 30. t. 131. f. 8 — 10. t. I I I. f. 2. — Helicolimax major. *Férussac*, *Essai*, 43. — Vitrina major. *Pfeiffer*, *L. and S. Moll.* i. 47. — Limacina pellucida. *P. Hartmann*, *N. Alp.* i. 246.—Helicolimax Audebardi. *Féruss. Tab. S.* 21. *H. Moll.* t. 9. f. 5. — Vitrina Mülleri. *Jeffreys*, *Linn. Trans.* xv. 326. — Vitrina Draparnaudi. *Jeffreys*, *L. T.* xvi. 326. — Helicolimax pellucidus. *Férus. Hist. Moll.* t. 9. f. 6. — Helicolimax pellucida. *Blainv. D. S. N.* xxxii. 255.—Vitrina Audebardi. *Pfeiffer*, *L. and S. Moll.* iii. 55. — Helix limacoides. *Alten*, *Syst.* 85. t. 11. f. 20. — Vitrina membranacea. *Brown*, *Il.* t. 40. f. 345. — Vitrinus pellucidus. *Montf.* ii. 239.—Vitrina diaphana; Vitrina depressa; Vitrina Dillwynii. *Jeffreys*, *L. T.* xvi. 326. — Vitrina elongata. *Jeffreys*, *L. T.* xvi. 326.; *Turton*, *Man.* ed. 1., not *Drap.*—Vitrina beryllina. *Pfeiffer*, 47. t. 3. f. 1.—Cobresia helicoides vitrea. *Studer.*—Hyalina pellucida. *Studer.*

In woods, among decayed leaves, and under stones. (*Fleming*, 1809.)

Animal light-coloured above, with black head and horns; under part light-coloured, bordered with black; air-valve, when closed, with a black spot, when open, surrounded by a black ring. (*Sturm*, *Fauna*, t. 9.; *Pfeiffer*, l. c.)

Shell half an inch in diameter, not so much in height, extremely thin and transparent, of a pale watery green, and quite smooth; volutions three, the first very large and a little oblique, the others but little raised and ending obtusely; aperture very large, oval-elliptic, rather oblique, interrupted at top by the prominency of the second volution, with the margin thin and membranaceous, often coloured with a pale brown border, without internal rib; the suture well marked, and when magnified exhibiting a striated spiral line; pillar lip a little reflected, and forming a slight concavity, but not an umbilicus.

1. Shell varies as to the colour of its suture; in some this is whitish and more wrinkled than in others, in some it is brown, whilst in others the brown, in particular lights, appears as if gilded.

2. The green colour of the shell also varies in hue.

Dr. Fleming first observed this species in Britain; for he says that he sent it to the late Mr. Montagu in 1809, who considered it as the fry of the *Helix nitida*. (See *Leach*, *H. nemoralis*.) Brown described it as British in 1819, and it was noticed as English by M. Férussac and myself in 1820 and 1821.

Captain Brown, in his *British Shells*, figures under

the name *Vitrina margaritacea*, t. 40. f. 54, 55, 56., a shell which I have not been able to see; the figure is more like a *Zonites* than a *Vitrina*.

The animal is very hardy; for, according to Nilson, it is found crawling about amongst leaves in the southern part of Sweden in the depth of the winter, and it is also found in the most northern part of that country.

** *Mantle not produced in front, simply lining the cavity of the shell, with a thicker edge or collar enclosed within the edge of the shell, in which is placed the respiratory cavity.*

† *Body and mouth of the shell depressed, being broader from side to side than long from front to back, that is to say in the direction of the axis of the spiral shell.* (Helicina.)

3. ZONITES *Montf.* (Zonites.)

Animal with an elongate depressed foot, and a large produced central spiral body, covered with (and contractile into) a depressed or hemispherical, thin, smooth, polished shell, with flattish spire, and a large lunate mouth, with thin simple lips, which are neither thickened nor reflexed; the tentacles are four, the two lower ones small and club-shaped; tongue narrow, with from 30 to 60 longitudinal series of teeth, with elongated apices.

The tongue of *Zonites alliarius*, *cellarius*, *nitidulus*, and *radiatulus* greatly resemble each other, and are somewhat intermediate between *Vitrina* and

*Helix;* for while their edge teeth show no appearance of bifurcation, the heel to the apex may possibly be looked upon as an approach toward it. Their sagittate central tooth corresponds with that of *Vitrina;* and a similarly shaped central tubercle in *Helix fulva* connects them with the true *Helices,* which have a simple aculeate tubercle.

The jaw is like those of *Limax* and *Vitrina,* broad, smooth, with a central rostrum.

The animal can entirely withdraw itself into the shell; and this genus is at once known from the *Helix* by the thinness and generally polished state of the shell, and also by its being depressed and destitute of any internal rib round the edge of the mouth.

It is intermediate between the Helices and the foreign genera *Stenopus* and *Nanina* of the family *Arionidæ.* The animal also resembles the latter in some respects, but wants the gland on the end of the foot. According to M. Moquin Tandon, there is a small longitudinal slit at the end of the tail of *Zonites nitidus.* It is very probable that other peculiar characters will be found when the animals of the different species of *Helicidæ* have been described and compared together, as Mr. Nunneley has so excellently well done with the species of slugs.

a. *Shell depressed, yellowish; whorls moderately enlarging; umbilicus large.* (Aplostoma.)

25. 1. ZONITES *alliarius.* Garlic Snail.—Shell nearly flat, slightly globular, thin, transparent, horn-coloured, very shining, nearly smooth; whorls

four, under side slightly tinged with opaque white; umbilicus rather large (t. 4. f. 39.).

Helix alliaria. *Miller*, *Ann. Phil.* n. s. vii. 379.; *Alder*, *Cat.* 12. n. 48.; *Mag. Zool. and Bot.* ii. 108.; *Turton*, *Man.* ed. 1. 56. f. 39.—Helix nitens. *Sheppard*, *Linn. Trans.* xvi. 160. —Helix lurida. *Studer*, *Verz. S. C.*—Helix tenera. *Hartm. N. A.* i. 232.—Polita glabra. *Held. in Isis*, 1837, 619.—Helicella glabra. *Beck*, *Ind.* 6.—Zonites alliarius. *Gray*, *Man.* 168. t. 4. f. 39.; *Forbes and Hanley*, *B. M.* iv. 34. t. 120. f. 5, 6.—Zonites (Aplostoma) alliarius. *Moq. Tand. Moll. Franc.* ii. 83. t. 9. f. 9—11.—Helix fœtida. *Stark*, *Elem. N. Hist.* ii. 59.; *Brown*, *Brit. Shells*, t. 40. f. 48—52. —Helix alliacea. *Jeffreys*, *Linn. Trans.* xiii. 341. 511.—Helix nitida. *Shepp. Linn. Trans.* xiv. 160. (?)

Var. 1., transparent greenish white.

Var. 2., larger. *Alder*, *Mag. Zool. and Bot.* ii. 108.—Helix glabra. *Studer*, *Férus. Prod.* n. 215.

Inhab. woods, under stones, decayed leaves, and moss. (*Mr. Miller.*)

Animal black; tentacles short, cylindric, emitting a strong smell of garlic when irritated.

Shell about one quarter of an inch in diameter. It differs from *Z. cellaria* in being not above one third the size, and more convex, in having the aperture less oblique, the umbilicus larger, and the white on the under side not so well defined; from *Z. nitidula*, in being smaller, and in its bright glossy lustre and transparency.

Dr. Johnston does not consider *H. nitida* and *H. nitidula* as distinct from *H. alliaria* of Miller; he found all under one stone, selected four nearly of one size; and none of them had any garlic smell when alive, but on immersing them one by one in hot water, two emitted a very strong garlic-like odour; in one it was faint, and in the other it was

not perceptible. It would appear, therefore (he continues), that the animal has the power to retain or emit its peculiar odour at pleasure, and that in death its emission may be prevented by accidental circumstances: he thinks it arises from the yellow fluid pressed out about the head.

26. 2. ZONITES *cellarius*. Cellar Snail. — Shell flat, pale yellowish horn-colour, transparent, shining, very slightly wrinkled, with 5 or $5\frac{1}{2}$ whorls; the under side clouded with opaque white; umbilicus moderately large, exposing the second whorl. (t. 4. f. 40.)

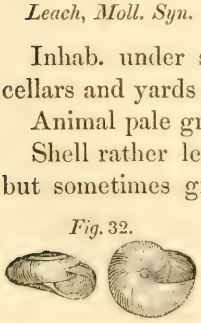
Helix cellaria. *Müller, Verm.* 28.; *Lam. Hist.* vi.; *Alder, Cat.* 12. n. 47.; *Mag. Zool. and Bot* ii. 208.—Helix nitida. *Drap. Moll.* 117. t. 8. f. 23. 25.; *Brard*, 31. t. 2. f. 2.—Zonites cellarius. *Gray, Manual*, 170. t. 4. f. 40.; *Forbes and Hanley, B. M.* iv. 33. t. 120. f. 1, 2, 3. t. H H H. f. 3. — Oxychilus cellaria. *Fitz. Sys.* t. 100. — Polita cellaria. *Held. Isis*, 1837, 906. — Helicella cellaria, and H. Draparnaudii. *Beck, Ind.* 6.—Zonites (Aplostoma) cellarius. *Moq. Tand. M. Franc.* ii. 78. t. 9. f. 1, 2. — Vortex cellaria. *Oken, Lehrb.* iii. 314. — Helix nitens. *Maton and Racket, Linn. Trans.* viii. 198. t. 5. f. 7.; *Férussac, Prod.*— Helix lucida. *Montag. T. B.* 425. t. 23. f. 4.; *Turt. Man.* ed. 1. f. 40. — Zonites lucida. *Leach, Moll. Syn.* 75.

Inhab. under stones in fields and woods, and in cellars and yards in cities.

Animal pale grey, white when young.

Shell rather less than half an inch in diameter, but sometimes growing to nearly three quarters of an inch, glossy, and irregularly striate, with 5 or $5\frac{1}{2}$ volutions, which are well defined by the suture; underneath milky-white,

*Fig.* 32.



especially about the umbilicus, which is large and very deep; aperture oblong crescent-shaped, compressed, oblique, as long as it is wide.

Mr. Alder observes that continental specimens of this shell are larger, and rather more open in the umbilicus, than British ones, which induced M. de Férussac to think that they might be distinct. The same remark is applicable to *Helix nitidula;* but in both cases he thinks it amounts to nothing more than a variety. *H. nitens* (Fér. Tab. Moll.) is only the English variety of the species in a small state.

*H. nitens* of Michaud, if we may judge from the figures, is *H. nitidula* Drap. Mr. Alder suspects Michaud's *H. nitidula* is, like that of Pfeiffer, the *H. nitidula* var. *β* of Drap., which is his *H. radiatula.*

27. 3. ZONITES *purus.* Delicate Snail. — Shell depressed, rather shining, transparent white, slightly striated or wrinkled, with four shining whorls set diagonally; under side more flattish than the upper, and without any appearance of opacity; umbilicus rather large. (t. 4. f. 43.)

Helix crystallina. *Flem. B. A.* 262.(?)—Helix viridula. *Menke, Syn.* 127.—Helix lenticula. *Held. Isis,* 1837, 304.— Polita nitidosa and P. clara. *Held. Isis,* 1837, 916.— Helicella nitidosa. *Beck, Ind.* f. — Helix electrina. *Gould, Boston Jour. N. H.* iii. 423. t. 22. f. 2.— Helix pura. *Alder, Cat.* 12. n. 46.; *Mag. Zool. and Bot.* ii. 108.; *Turton, Man.* ed. 1. 59. (not the figure). — Helix nitidula var. *β. Drap. Moll.* 117. t. 8. f. 21, 22.; *Jeffreys, Linn. Trans.* xiii. 511.— Helix Alderi. *Bean, MSS., Brit. Mus.* — Zonites purus. *Gray, Man.* 171. t. 4. f. 43.; *Forbes and Hanley, B. M.* iv. 27. t. 221. f. 5, 6.— Z. (Aplostoma) purus. *Moq. Tandon, Moll. Franc.* ii. 87. t. 9. f. 22. 25.

Var., shell pale horn-colour; animal rather darker (*Alder, Cat. Mag. Zool. and Bot.* ii. 108.): Helix nitidosa. *Fér. Tab. Moll.* 214. (not synonyma); *Rossm. Jun.* i. 71. t. 1. f. 23.

Inhab. under stones, decayed leaves, &c., in woods.

Animal white, with two black lines; mantle white, speckled with black.

Shell varying from one fifth to one sixth of an inch in diameter, somewhat like *Z. crystallina*, but larger, more convex, and less shining, the whorls less closely set, and the outer one larger in proportion to the rest: the umbilicus is also larger.

Mr. Jeffreys considers it as a variety of *H. nitidula;* but Mr. Alder justly observes that it differs from that species in being scarcely one third the size, of a different colour, and without any trace of opacity underneath. This species preserves its characters unchanged even when living in the midst of its allies.

28. 4. ZONITES *nitidulus*. Dull Snail.—Shell nearly flat, deep yellowish horn-colour, sub-pellucid, rather strongly wrinkled, of a dull waxy appearance above, more shining below, except near the umbilicus, around which it is of an opaque white; whorls $4\frac{1}{2}$; umbilicus large, exposing the second whorl. (t. 12. f. 136.)

Oxychilus nitidulus. *Fitz. Syst.* 100.—Polita nitidula. *Held. Isis*, 1837, 216.—Helicella nitidula. *Beck, Ind.* 6.—Zonites nitidulus. *Gray, Man.* 172. t. 12. f. 136.; *Forbes and Hanley, B. M.* iv. 36. t. 120. f. 9, 10.—Z. (Aplostoma) nitidulus. *Moq. Tand. Moll. Franc.* ii. 83. t. 9. f. 12, 13.—Helix nitidula. *Drap.* 117. t. 8. f. 21, 22.; *Gray, Med. Repos.* 1821, 239.; *Shepp. Linn. Trans.* xiv. 160.; *Alder, Cat.* 134. 49.; *Mag. Zool. and Bot.* ii. 147.; *Jeffreys, Linn. Trans.* xiii. 340.

Var. 1. *Helmii*, t. 12. f. 136., transparent greenish white

(*Alder*, l. c. 107.): Helix Helmii. *Gilbertson, MSS. British Museum.*

Inhab. hedge sides, under stones, &c.

Animal dark lead-colour. (*Sturm*, t. 12.)

Shell about three tenths of an inch in diameter. Differs from *Z. cellaria* in being smaller, rather more convex above, and more concave beneath; of a dull lustre, darker colour, and more strongly wrinkled above; the umbilicus is larger, and the aperture set at a less oblique angle; the opaque white, also, is not so much diffused over the base of the shell, but it is confined to the edge of the umbilicus. The animal is of a darker colour. (*Alder.*)

Mr. Gilbertson thinks that there are some peculiarities in the habit of the animals, together with the white colour of the variety of the shell, which induces him to consider *Z. Helmii* as distinct from *Z. nitidulus*, but as yet he has not published his observations on it.

29. 5. ZONITES *radiatulus*. Rayed Snail.—Shell depressed, horn-coloured, rather shining, transparent, regularly striated; $3\frac{1}{2}$ or 4 whorls, flattened at their junction with the inner ones, over which the striæ appear continuous and strongly marked, giving the shell a radiated appearance (under a magnifier); the outer whorl rather large in proportion to the rest, under side smooth, without any whiteness; umbilicus moderately large. (t. 5. f. 50.? t. 12. f. 137.)

Helix striatula. *Gray, Med. Repos.* 1821, 239. *in B. M.*—Helix radiatula. *Alder, Cat.* 12. n. 50. 1830; *Mag. Zool. and Bot.*

ii. 207.; *Jeffreys*, *Linn. Trans.* xiii. 511.—Zonites radiatulus. *Gray*, *Man.* 173. t. 12. f. 137. *Forbes and Hanley*, *B. M.* iv. 38. t. 121. f. 1.—Z. (Aplostoma) striatulus. *Moq. Tand. Moll. Franc.* ii. 86. t. 9. f. 19–21.– Helix nitidula. *Pfeiffer*, *Michaud.*—Helix nitidula β. *Drap.*—Helix brevipes. *Turton*, *Man.* ed. 1. t. 5. f. 50.(??)

Var. 1. *Vitrina*, transparent, greenish white: Helix vitrina. *Férussac*, *Prod.*

Inhab. woods, &c. in wet moss. (*Gray*, 1821).

Animal black.

Shell about one twentieth of an inch in diameter.

This species may be distinguished from the young of the other Zonites by the regular and more distinct striæ, and particularly by the flatness of the whorls at their junctions.

30. 6. Zonites *lucidus*. Lucid Snail. — Shell depressed, rather convex, thin brownish horn-colour, transparent, shining, finely striated, whorls $4\frac{1}{2}$ or 5; umbilicus large, exposing the second whorl; aperture roundish. (t. 4. f. 38.)

Helix lucida. *Drap. Hist.* 103. t. 8. f. 11, 12. (not *Montagu*); *Brard*, 34. t. 2. f. 3, 4.; *Gray*, *Med. Repos.* 1821, 239.; *Turton*, *Man.* ed. 1. 56. f. 38. (not 40.) — Helix nitida. *Müller*, *Verm.*; *Alder. Mag. Zool. and Bot.* ii. 107.; *Jeffreys*, *L. T.* xvi. 339. — Helix tenuis. *Dillwyn*, *R. S.* ii. 913. — Helix Hammonis. *Ström*, *Act. Nedross*, iii. 435. t. 6. f. 16. — Helix nitens. *Gmelin*, *S. N.* 3633. — Helix succinea. *Studer* in *Coxe's Travels.* — Oxychilus lucidus. *Fitz. Syst.* 100.—Tachychlamys lucida. *Benson*, *P. Zool. Soc.* 1834, 89. — Polita lucida. *Held. Isis*, 1837, 916. — Helicella nitida, and H. succinea. *Beck*, *Ind.* 6. — Zonites lucidus. *Gray*, *Man.* 174. t. 4. f. 38.—Zonites nitidus. *Forbes and Hanley*, *B. M.* iv. 39. t. 120. f. 4. 7.— Zonites (Aplostoma) nitida. *Moq. Tandon*, *M. Franc.* ii. 72. t. 7. f. 11—15.

Inhab. moist ditches and marshy places.

Animal black or blackish grey; foot and lower

side of body grey; tentacles and neck black. (*Sturm*, t. 11.)

The shell appears dark chocolate when the animal is alive, and is about a quarter of an inch in diameter. It differs from *Z. cellaria*, *Z. alliaria*, and *Z. nitidula* in being more convex, more regularly striated, of a darker colour, and without any trace of opacity on the under side.

*Fig.* 33.

Nilson describes the eggs as depressed, globose, covered with a white calcareous shell. They are solitary, and deposited in May or June. This snail is sometimes so abundant in pine-beds and orchideous houses as to be a great detriment to the plant; hence they have been called *Pine Snails* and *Orchideous Snails.*

31. 7. ZONITES *excavatus.* Excavated Snail.—Shell sub-globular, depressed, shining, transparent horn-colour, regularly striated; whorls $5\frac{1}{2}$ or 6, rather rounded and closely set; base much rounded, umbilicus very large and deep, exposing all the whorls to the tip; aperture nearly orbicular lunate. (t. 4. f. 39., t. 12. f. 138.)

Helix excavata. *Bean, MSS.*, in *Alder, Cat.* 13. n. 52.; *Mag. Zool. and Bot.* ii. 107.; *Pfeiffer, Mon. Hel.* i. 98. — Helix lucida var. *Turton, Man.* ed. 1. 57. t. 4. f. 39. — Helix nitida *a. Jeffreys, Linn. Trans.* xiii. 339. 511. — Zonites excavatus. *Gray, Man.* 175. t. 12. f. 138.; *Forbes and Hanley, B. M.* iv. 40. t. 121. f. 2, 3, 4.

Inhab. under decayed wood, and timber that has lain some time on the ground.

Animal lead-coloured.

Shell about one quarter of an inch in diameter; it very much resembles *Z. lucida*, but may be distinguished from it by its greater convexity both above and below, and by its peculiarly large umbilicus; the whorls are also rather more convex and more closely set, and the outer whorl is not so large in proportion to the rest; the striæ are rather stronger, the animal lighter coloured, and it frequents a different situation. The shell varies in being paler.

b. *Shell depressed, diaphanous; whorls enlarging very gradually; axis perforated.* (Discella.)

32. 8. Zonites *crystallinus*. Crystalline Snail. — Shell flat, glossy, of a greenish-crystalline transparency, with six very gradually increasing volutions; aperture semi-lunate; umbilicus small. (t. 4. f. 42.)

Helix eburna. *Hart. N. alp.* i. 234.—Helix cristallina. *Férus. Prod.* n. 223. — Discus crystallinus. *Fitz. Syst.* 99. — Polita crystallina. *Held. Isis*, 1837, 916. — Helicella crystallina. *Beck, Ind.* 7. — ? Helix hydatina. *Rossm. Icon.* f. 529. — Helix vitrea. *Brown, Edinb. Jour.* i. t. 1. f. 12, 13, 14. — Helix crystallina. *Müller, Verm.* 223.; *Drap.* p. 118. t. 8. f. 13—18.; *Gray, Med. Rep.* 1821, 239.; *Alder, Cat.* 108.; *Turton, Man.* ed. 1. 58. f. 42.; *Jeffreys, Linn. Trans.* xiii. 341. 511.; *Pfeiffer, Helic.* i. 59. — Zonites crystallinus. *Leach, Moll. Syn.* 76.; *Gray, Man.* 176. t. 4. f. 42.; *Forbes and Hanley, B. M.* iv. 41. t. 122. f. 1, 2.

Var. Helix hyalina. *Férus. Tab. Moll.* 224. ?; *Alder, Cat.* 108.

In wet meadows, among moss and leaves. (*Gray*, 1821.)

Animal milky white; neck long; tentacles dark, long. Very active.

Shell, when enclosing the animal, very shining white, fulvous on the spire, hardly the eighth of an

inch in diameter, flat above, and a little convex beneath, with six volutions, which enlarge gradually from the centre; of a crystalline or watery transparency with a slight tinge of green; aperture crescent-shaped; umbilicus deep and rather large.

It may be known from the young of any of the former species by its watery transparency, and by the number and regularity of its volutions, which increase in a gradual proportion, not having the outer one much larger than the rest.

c. *Shell trochiform, shining; axis imperforated.* (Conulus.)

33. 9. ZONITES *fulvus*. Top-shaped Snail.— Shell rather conic and trochiform, beneath flattish, with six volutions, dark horn-coloured, smooth, and glossy; aperture narrow, crescent-shaped; umbilicus minute. (t. 5. f. 47.)

Helix fulva. *Müller*, *Hist.* 36.; *Nilson*, 13.; *Drap.* p. 81. t. 7. f. 12, 13.; *Rossm. Icon.* viii. f. 535.; *Forbes and Hanley*, *B. M.* iv. 75. t. 118. f. 8, 9.— Teba fulva. *Leach*, *Moll. Syn.* 72.— Helix trochiformis. *Mont.* p. 427. t. 11. f. 9.; *Jeffreys*, *Linn. Trans.* xvi. 331., not *Férussac.*— Helix Trochulus. *Müller*?? *Dillwyn*, p. 916.— Helix nitidula. *V. Alten*, *Erd. u. Flus. Conch.* 53. t. 4. f. 8.— Helix Trochilus. *Fleming*, *B. A.* 260.— Helix chersina. *Say*, *Jour. Acad. Philad.* ii. 156.; *Gould. Inv. Mass.* 135. f. 105.— Helix Mandralisci. *Bivon.*— Cornulus fulvus. *Fitz. Syst.* 94.— Polita fulva. *Held. Isis.* 1837, 916.— Petasia trochiformis. *Beck*, *Ind.* 41.— Zonites (Conulus) fulvus. *Moq. Tandon*, *Moll. Franc.* ii. 67. t. 8. f. 1—4.

Var. 1. *Mortonii*, shell depressed, both sides nearly equally convex: Helix Mortonii. *Jeffreys*, *Linn. Trans.* xvi. 332.— "Trochus terrestris β. Mortonii *Da Costa*." *Jeffreys.*

Var. 2. *Alderi*, smaller, darker. *Alder*, *Mag. Z. and B.* ii. 108.

Inhab. woods, among leaves and under stones, and on decayed wood.

Animal grey, shining; foot thin; tentacles long.

Shell the tenth of an inch in diameter, glossy, dark horn-coloured, with six rounded volutions, which are much raised and strongly defined; the base prominent, with a depression in the centre forming an incipient umbilicus; aperture transverse, narrow, as high as broad; with a very thin margin reflected only near the depression, which in young shells is hardly visible. Varies in the intensity of the colour and in transparency, the specimens found in very damp situations being generally much darker and more polished; epiphragm transparent.

Mr. Alder observes that the small variety is not uncommon; it is darker coloured, and with very delicate and beautiful concentric striæ on the base only visible with a high magnifier, which induced him at first to consider it distinct; but on closer examination he found slight traces of these striæ visible on the full-grown and decided specimens of *H. fulva;* he has therefore not ventured to separate it. (l. c. 108.)

### 4. Helix. (Snail.)

The animal moderate, with an elongate depressed foot, and a large, produced, central, spiral body covered with a subglobose or depressed shell, with a lunate mouth, which is generally broader than long, strengthened with an internal thickened rib, and more or less reflexed edges; tentacles four, the two lower small, club-shaped. Tongue broad, with many (100 to 200) longitudinal series of flat square teeth, with rounded tips.

These animals have a distinct and very variously divided *vesicula multifida*, which is wanting in *Succinea*, *Bulimus*, and other allied genera.

*Fig.* 34.

*Helix cantia*

The young shells have the outer whorls generally more or less keeled, and the axis is always umbilicated or perforated; but the perforation is sometimes masked by the reflexion of the outer lip of the adult shell over it.

This genus is known from *Zonites* by the thickening of the outer lip, from *Vitrina* by the axis being perforated, from *Succinea* and *Bulimus* by the axis being depressed (and not elongate), making the shell subglobose or depressed.

The animals, at the approach of winter, or in very dry weather in summer, recede into their shell, and secrete a quantity of mucus, which being moulded, as it were, on the retracted part of the mantle which encloses the folded-up foot, forms, when it dries by exposure, a cover to the aperture, which is usually membranaceous, with a triangular perforation over the respiratory hole of the mantle.

In some species, as *Helix Pomatia*, the membrane becomes strengthened with a quantity of calcareous matter, which is first deposited on the triangular spot before referred to. In this case, the animal forms several membranaceous coverings, a little distance from one another, within the outer, hard, calcareous one, similar to the membranaceous covering of other

Helices. On the approach of warm or damp weather, the animal softens the adhesion that has taken place between the lid and the edge of the mouth of its shell, by emitting a small quantity of fluid mucus; and the cover is thus easily thrown off by the pressure of the foot. When another is required by external circumstances, the process is commenced afresh. This lid gives the name *Pomatia* to our largest snail. Lister called the lid the *operculum saliva confectum;* Müller calls it the *operculum hybernum*, or winter lid; and more recently it has been named by Draparnaud the *epiphragm:* the latter name has been generally adopted. Montagu has been blamed for calling it an *hybernaculum;* but this arises from a mistake. Montagu intended by the latter name the hole in which the animal buries itself, as is proved by his use of the term at p. 407.

The Helices will eat meat and other extraordinary substances. I have often observed the common garden snail (*H. aspersa*) eating the posting-bill from the walls of the environs of London after a shower. (*Ann. and Mag. N. H.* ii. 310., 1839.)

The power of forming this kind of epiphragm, and the thickening of the outer lip, has been considered a peculiar character of the land Mollusca; but it is now known that pond snails (*Limnæus* and *Planorbis*), when left dry by the evaporation of the water in which they have been living, thicken the edge of the lip, and form a distinct epiphragm.

Though the British species are not very numerous, it has been thought advisable to divide them into several sections, to facilitate their determination, and

also to show the natural groups into which the numerous exotic species naturally fall.

The size of the land Mollusca and their shells are very subject to variation, according to the quantity of food they can procure and the temperature of the district they inhabit. Those inhabiting the warmer countries are generally larger than those which inhabit a colder climate, produced either by geographic position or a more elevated situation in a southern latitude. The small size in the latter instance is probably caused by the animal being for a longer portion of the year in a torpid or hibernating condition.

a. *Shell subglobose banded; peristome rather thickened, reflexed, with an internal rib; axis perforated, perforation covered in the adult specimens; epiphragm membranaceous. Jaws strong, toothed.* (Acavus *Montf.* Tachea *Leach.*)

34. 1. HELIX *aspersa.* Common Snail. — Shell somewhat globular, with the surface wrinkled, yellowish-brown or olive, with four brown bands; whorls four; mouth roundish lunate; the peristome white and reflected. (t. 4. f. 35.)

Helix aspersa. *Müller, Verm.* ii. 59.; *Montagu*, p. 407.; *Drap.* p. 89. tab. 5. f. 23.; *Brard*, p. 7. tab. 1. f. 1.; *Turton, Mann.* 52. f. 35.; *Leach, Syn. Moll.* 60. t. 2. f. 1, 2.; *Jeffreys, Linn. Trans.* xvi. 328.; *Forbes and Hanley, B. M.* iv. 44. t. 116. f. 1. — Helix hortensis. *Penn. Zool.* iv. 136. t. 84. f. 129.; *Donovan*, t. 131.; *Turt. Dict.* p. 60. — Helix grisea. *Linn., S. N.* 1247.; *Dillwyn*, p. 943. — Helix lucorum. *Pulteney. Cat. Dors.* 943. — Cochlea vulgaris. *Da Costa*, p. 72. t. 4. f. 1. — Helix variegata. *Gmelin, S. N.* 3650. — Cœnatoria

aspera. *Held. Isis*, 1837, 910. — Pomatia adspersa. *Beck, Ind.* 44.

Inhab. gardens, old walls, &c. Common.

Animal warty, yellowish-grey, with a paler dorsal streak. (*Rossm. Icon.* t. 4. f. 75.) The jaw broad, costated in front, and toothed on the edge.

Shell an inch and a half in diameter, covered with a creased or coarsely wrinkled skin, somewhat globular, with the mouth a little longer than wide, the edge of which is slightly reflected; of a dull olive colour, with generally four interrupted brown bands, one and rarely two of them penetrating the mouth. It varies much in colours and markings, but is readily known by its wrinkled coat.

1. It varies in colour. Sometimes they are pale yellowish, without bands, but generally banded, sometimes the bands are all separate, but generally the second and third bands are united into one; sometimes all the bands are united together, which makes the shell appear darker, and marked with transverse pale lines.

2. It varies greatly in size according to the quantity of food, and the temperature of the place in which it lives.

Monstrosities sometimes occur: — 1. Reversed, or with the whorls turned in a contrary direction. 2. With the spire elongated, and conical when the whorls are rounded. 3. With the whorls produced, and separated from one another*: the latter has been called — Cornucopia *Born, Mus.* 262. Serpula Cor-

* A figure of this monstrosity ornaments the covers of this work.

nucopia *Gmelin.* Serpula helicina *Solander.* Cornucopia helicina *Shaw, Nat. Misc.* xiv. 568. Cornucopia monstrosa *Chemn.*

The internal spicula or darts, which this species ejects in the spring of the year, are about a quarter of an inch long, slender, and tapering to a fine point, exactly square, with four sharp angles, rounded and hollow at the top like the socket of a joint. A magnified figure may be seen in Lister's anatomical tables at the end of his *Conchology,* t. 2, 3. f. 1, 2.

The snail which inhabits this shell seems to be more influenced by the weather than many of the smaller sort; for upon the first appearance of cold they creep into crevices and under stones, clustering together and clinging to each other, as if they were capable of communicating warmth by association. They are the pest of gardens, especially such as are inclosed by hedges and old walls. Upon many of them are found a series of thin circular layers placed horizontally; these are the laminar foliations of the winter epiphragm left by another of the species which had been attached to it.

This snail is collected and sold in Covent Garden and other markets, as a cure for diseases of the chest, boiled in milk; and quantities of them are collected and packed in old casks, and sent to the United States of America as delicacies. In this manner they travel very well, as they fix themselves on one another round the circumference of the cask, leaving a vacant space in the centre.

The glassmen at Newcastle once a year have a snail feast; they generally collect the snails them-

selves in the fields and hedges, the Sunday before the feast day.

35. 2. HELIX *hortensis*. Garden Snail. — Shell somewhat globular, thin, smooth, yellow or brown, uniform or banded; mouth roundish lunate, depressed, with the peristome white. (t. 3. f. 24.)

Helix hortensis. *Lister*, *Conch.* t. 3. f. 3.; *Linn.* (?); *Müller*, *Verm.* ii. 52.; *Drap.* p. 95. tab. 6. f. 6.; *Brard*, p. 16. tab. 1. f. 3.; *Montagu*, p. 412.; *Jeffreys*, *Linn. Trans.* xvi. 330.; *Alder*, *M. Z. and B.* ii. 106.; *Turton*, *Mann.* 34. f. 24. — Tachea hortensis. *Leach*, *Syn. Moll.* 62. — Cochlea fasciata. *Da Costa*, p. 76. t. 5. f. 4, 5. — Helix nemoralis var. *Maton and Rachet*, *Linn. Trans.* viii. 206.; *Dillw. Cat.* ii. 942.; *Forbes and Hanley*, *B. M.* iv. 53.

Inhab. woods, hedges, and wet shady places.

Animal reddish, yellowish, or pale grey; tentacles generally dark grey. (*Sturm*, t. 22.) Jaw strong, costated in front, edge toothed.

Shell about a fourth part smaller than *H. nemoralis*, which in colour and varieties it much resembles, but is distinguished by its smaller size, in not being quite so convex, in being more polished and thinner, and in the white margin round the aperture.

Like many other snails, it offers the following monstrosities: — 1. In the whorls being reversed. (*Férus.* t. 36. f. 10.) 2. And in the whole of the spires being more or less separated from each other. (*Férus. Hist.* t. 36. f. 11, 12.)

In the *Annals of Philosophy* for 1825, p. 152., I observed that there was a difference in the form of that part of the generative organs of *Helix nemoralis*

and *H. hortensis* called *vesicula multifida* by M. Cuvier, in his dissection of *Helix Pomatia*, and further observed that this name for the organ gives an erroneous impression, as in several of the Helices it is simply forked, and in others doubly forked, and rarely many-cut, as it is in the edible snail.

Helix hortensis has been introduced into the United States, where it is observed that, unlike the American Helices, they are not found burrowing under stones and decayed leaves, but on the ground, and crawling up the stems of plants. (*Gould, Mass.* 175.)

36. 3. HELIX *hybrida*. The Brown-mouthed Snail. —Shell somewhat globular, smooth, polished, brown or yellow, brown-banded, with the rib of the lip pale brown, and the edge whitish. (t. 11. f. 130.)

Helix hybrida. *Poiret, Coq. Terra Fluv. Aisne*, 71.; *Gray, Man.* 132. t. 11. f. 130. — Helix hortensis var. *Férussac, Tabl.* 31.; *Alder, Mag. Z. and B.* ii. 106. — Helix nemoralis part. *Forbes and Hanley, B. M.* iv. 53. — Helicogena hybrida. *Beck, Ind.* — Tachea hybrida. *Hartm.* — Helix fusca. *Poiret, Paris.*

Inhab. woods and hedges with the former.

The animal of this species differs from either *Helix hortensis* or *H. nemoralis*, in the form of the *vesicula multifida*, as well as in the colour of the mouth of the shell. In all its characters it is intermediate between these two species; but yet I do not think there is any reason to believe that it is a mule, or that it unites them into one species. This species does not seem to be so variable in its colour as either of its allies. The jaw is strong, costated, and toothed.

Mr. Alder notices this species in his catalogue of Newcastle shells:—"A curious pale brown variety of this species (*H. hortensis*) occurs at Stella, the lips being of a paler shade of the same colour, and rarely white."

M. Deshayes believes this animal to be the mule of the two species, as the name indicates; he says they are not sterile (*Lam. H.* ed. 2. vi. 53.). He had not observed the peculiarity in the *vesicula multifida.*

Messrs Brard and Deshayes propose to unite *Helix nemoralis* and *H. hortensis* into one species. M. Deshayes states that he has often seen the two kinds in copulation; that these connections he believes to be fertile, for in the same situation he has found the *Helix hybrida* with its rosy mouth; and more lately M. Deshayes proposes to consider *Helix nemoralis, H. hortensis, H. hybrida, H. sylvatica,* and *H. austriaca,* as all varieties of the same species. (*Hist. Anim. s. Verteb.* viii. 56.)!

37. 4. HELIX *nemoralis.* Girdled Snail. — Shell somewhat globular, smooth, yellowish or brown, and mostly 5-banded, with the mouth roundish lunate, compressed; margin of the aperture brown. (t. 3. f. 23.)

Helix nemoralis. *Linn. S. N.* i.; *Montagu*, p. 411.; *Drap.* p. 94. t. 6. f. 3—5.; *Brard*, p. 12. t. 1. fig. 2 and 4.; *Jeffreys, Linn. Trans.* xvi. 330.; *Sheppard, L. T.* 163.; *Forbes and Hanley, B. M.* iv. 53. t. 115. f. 1—4. — Tachea nemoralis. *Leach, Syn. Moll.* 61. — Cochlea fasciata. *Da Costa*, p. 76. t. 5. f. 1, 2, 3. 8. 19. — Helix cincta, and H. quinquefasciata. *Sheppard, L. T.* 163. — Cochlea versicolor. *Humph, M. C.* — Helix turturum. *Stewart, Elem. N. H.* ii. 413. — Helix

mutabilis part. *Hartm. N. alp.* i. 242. — Helicogena nemoralis. *Risso, Eur. M.* iv. 60. — Cæpæa nemoralis. *Held. Isis*, 1837, 910. — Helix subglobosa. *Binney, Boston Jour. N. H.* i. 485. f. 7.

Inhab. woods and hedges.

Animal dirty or yellowish-grey; head, tentacles, and two streaks from the tentacles blackish (*Sturm*, t. 24.). Jaw strong, costated, and toothed.

Shell hardly an inch in diameter, and about three quarters high, glossy, semitransparent, finely striate; spire composed of five rounded volutions; aperture semielliptic, longer than wide, the peristome produced at the pillar in a nearly straight line, where it is flattened and thickened, surrounded by a chocolate or reddish-brown border.

The shell varies —

1. Greatly in the intensity of the colour, being sometimes pellucid white, yellow, reddish, or brown.

2. In being plain, or marked with five or fewer bands (some of the bands being deficient).

3. In the bands varying very considerably in breadth, being sometimes narrow, at others broad, when two or more of them are often confluent.

4. The bands are generally black or brown, but sometimes pellucid and nearly colourless.

5. In size, according to the abundance of food, or locality.

Monstrosities, with the whorls much produced, or even detached from one another, or turned in the contrary direction, sometimes occur. (See *Férussac, Hist. Moll.* t. 34. f. 8, 9. t. 32. *a.* f. 2.)

Mr. Sheppard believes that the plain sort (*H. nemoralis* Shepp.), the one-banded (*H. cincta* Shepp.),

and the five-banded (*H. fasciata* Shepp.) are distinct kinds, because he says they always breed together! He also observes that the spicula of the one-banded kind is four-sided in the middle, and perfectly straight; in the five-banded it is also four-sided in the middle, but curved, as in *H. aspersa!*

When the shells are lying exposed to the sun without any shelter, their upper surface often becomes of a fine pink or rose-colour.

The eggs are white, ovate. (See *Pfeiffer*, t. 7. f. 3.)

The animals sometimes have a morbid appetite, and eat worms, and even cooked meats. (See *Sow. Zool. Journ.* i. 285.)

On this animal is sometimes found a parasitic insect, which has caused considerable interest among the entomologists, and which has proved to be the larva of *Drilus flavescens.* (See *Mielzinsky, Isis,* xvi. (1825), p. 477.)

The last three species in their normal state have five spiral bands; the three hinder being continued on the whorls of the spire, and the anterior hidden in the cavity of the shell.

One or more of the bands are rarely divided longitudinally, when the shell appears to have six or seven bands.

One or more bands are sometimes more or less distinctly deficient; in other specimens some two or more of the bands are confluent together, making a single broad band.

In other specimens the colouring matter which forms the band is diffused over the whole surface of the shell, and sometimes the bands are interrupted.

Some shells change the character of their marking during the life of the snail; thus some that have all the bands separate in the young state, have one or more bands united together in the older or more recently formed part of the shell, and *vice versâ*.

Sometimes, instead of the bands being darker than the ground colour of the shell, they are paler and more transparent.

The ground colour of the shell also varies from very pale whitish to opaque white, yellow and yellowish red to dark red or brown.

M. Moquin Tandon divides the three specimens into varieties according to the bands and colours, naming them after conchologists, and in this manner indicates no less than 77 named kinds of *H. nemoralis* and 46 of *H. hortensis!*

b. *Shell subglobose, solid, banded; peristome rather thickened, reflexed; axis perforated; epiphragm calcareous, with several membranaceous ones within it.* (Pomatia *Gesner.*)

38. 5. HELIX *Pomatia.* Edible Snail. — Shell nearly globular, solid, striate, pale rufous, with obscure darker bands; aperture roundish lunate; peristome thickened, slightly reflexed. (t. 4. f. 34.)

Helix Pomatia. *Linn. S. N.* i.; *Montagu*, p. 405.; *Drap.* p. 87. t. 5. fig. 20—22.; *Brard*, p. 19. tab. 1. fig. 5.; *Forbes and Hanley, B. M.* iv. 46. t. 116. f. 2. — Cochlea Pomatia. *Da Costa*, p. 67. t. 4. f. 14. — Cochlea edulis. *Humph. M. C.* — Pomatia antiquorum. *Leach, Moll. Syn.* 64. — Cœnatoria pomatia. *Held. Isis*, 1837, 910. — Helicogena pomatia. *Hartm.* i. 98. t. 29, 30. 35.

Inhab. woods and hedges, on chalky soil and oolite formations in the southern and midland counties of England.

Animal warty, pale greyish brown, beneath grey; tentacles long, paler; foot dilated, netted with impressed lines, beneath ashy (*Sturm, F.* t. 21.). The jaw is strong, with ribs on the front and teeth on the edges.

Shell two inches long and as much high, rather solid, with the body volution extremely large and inflated, the others very little rounded, strongly striate across, and minutely so in a spiral direction; colour whitish, with the bands hardly visible, or pale tawny, with usually four darker bands, two of them penetrating the aperture at the pillar; aperture somewhat orbicular, longer than broad, with the margin thick, and reflected at the pillar so as in general to cover the umbilicus, or nearly so; the inside of a pale violet brown.

The shell varies greatly: 1. in size; 2. in the intensity of the bands; 3. in the ventricoseness, and 4. in the height of the spire. Monstrosities are sometimes found with the spire depressed, when it is *Helix pomana* of Müller; and others with the spire produced and conical, when it is *H. scalaris* of the same author. 5. It is sometimes reversed; and very rarely the whorls are separated one from the other like a cornucopia. (See *Féruss. Hist.* t. 21. f. 7, 8, 9.)

The eggs are globular, covered with a white, opaque coriaceous skin, and are about two and a half lines in diameter. They are figured by Pfeiffer (t. 7.

f. 2.) who has given a most complete and interesting description of all the changes which the egg undergoes during its hatching, in the first plate of the third part of his work.

From the time of the Romans, who fattened them as an article of food, they have been eaten by various European nations, dressed in various ways. Petronius Arbiter twice mentions them as served up at the feast of Trimalchio (Nero), first fried, and again grilled on a silver gridiron.

At one period it seems that they were admitted at our own tables; as Lister, in his *Hist. Anim. Angl.* p. 111., tells us the manner in which they were cooked in his time: "They are boiled in spring-water, and when seasoned with oil, salt, and pepper, make a dainty dish." ("Coquuntur ex aquâ fluviatili, et adjectis oleo, sale et pipere, lautum ferculum præparant.") And Ben Jonson, in "Every Man in his Humour," mentions this dish as a delicacy:

> "Neither have I
> Dressed snails or mushrooms curiously before him."

These circumstances suppose their long foreknown establishment in this country, and, together with their general diffusion in certain soils, incline us to consider them as indigenous, and not introduced by Sir Kenelm Digby for medicinal purposes, nor, according to Da Costa, by Mr. Howard as an article of food.

Dr. Turton observes: "After the animal has been extracted, there remains at the bottom of the shell a glairy transparent matter, which affords one of the

best and most durable cements in nature, resisting every degree of heat and moisture."

*Helix pomatia* is nearly confined to the chalk district of the south of England: it has been found as far north as Wiltshire. Miller says it is rare in a park at Bristol (where it might have been introduced). According to Montagu, "it is not an aboriginal species in this kingdom, but was first introduced about the middle of the 16th century, either as an article of food, or for medicinal purposes. It is supposed they were first imported from Italy, and turned out in Surrey by a Mr. Howard at Albury. It is also said that Sir Kenelm Digby [about 1630?] dispersed them about Gothurst, near Newport Pagnel in Buckinghamshire; and Mr. Morton informs us they were turned out by Lord Statton, at Kirby in Northamptonshire." Dr. Turton observes that their having been used as food, as mentioned by Lister (to which I may add the fact of Merret having mentioned them without any note, as found in Sussex, in his *Pinax*, published in 1667), strongly militates against the idea of their being of foreign origin. They have been said to be found as far north as Devizes, in Wiltshire, and in Gloucestershire. I believe they are rather restrained by the limits of the chalk basin than by the climate, as they are abundant in the Botanic Garden, and the gardens of the nobles in the south of Sweden, where the climate is much more rigorous; and I have no doubt that, if they could pass the other strata, they could live on the chalk in Yorkshire. "Some years ago they were introduced into Scotland by Patrick

Neil, Esq., and placed in his curious and most interesting garden at Cannon Mills; but we believe they have not prospered, and are gradually disappearing." (*Johnston, Mag. N. Hist.* 47.)

c. *Shell subglobose, banded; peristome rather thickened; axis perforated; epiphragm membranaceous.* (Arianta *Leach.*)

39. 6. HELIX *arbustorum.* Shrub Snail. — Shell somewhat globular, rather solid, brown or yellowish, marbled and marked with a single band; mouth roundish lunate; peristome reflexed, white. (t. 3. f. 25.)

Helix arbustorum. *Linn. Syst. Nat.* 1. 1245.; *Montagu*, p. 413.; *Drap.* p. 38. t. 5. f. 18.; *Brard*, p. 65. t. 2. f. 12.; *Pfeiffer*, t. 2. f. 7, 8.—*Forbes and Hanley, B. M.* iv. 48. t. 115. f. 5, 6. — Helix gothica. *Linn. S. N.* ed. 10. 770. — Helix Xatartii. *Farin. Ann. Soc. Nat.* ii. 1834, 122. — Helix Wittmanni. *Zawadzky in Rossm. Icon.* v. f. 279. d. — Arianta arbustorum. *Leach, Moll. Syn.* 63.; *Beck, Ind.* 41. — Cochlea unifasciata. *Da Costa*, p. 75. t. 17. f. 6. — Helix alpestris. *Ziegler in Ross. Icon.* v. f. 279. b. — Helix turgidula. *Wood, Index Supp.* t. 7. f. 6. — Helix picea. *Ziegl.* — Helix canigonensis. *Boubee.* —

Inhab. moist woods and river sides, in wet shady places among willows.

Animal granular, greenish black; hinder part of the foot and beneath, grey; tentacles shortish. (*Sturm*, t. 23.; *Rossm.* t. 5. f. 7, 8.) Jaw strong, costated, and toothed on the edge.

Shell about three quarters of an inch high, and as much in diameter, but variable in size and proportion, striate, mostly brown marbled with small yellowish spots, or greenish-yellow with whitish spots, with a single blackish band, which winds round the

middle of the lowest volution and continues round the base of the rest, not penetrating the aperture: this band is often faint, rarely wanting; aperture semielliptic, longer than wide, produced at the pillar side, with the margin slightly reflected and white, with a white internal rib.

The young shells have a thin lip, with a slight white internal rib.

It varies—1. In colour, from dark chestnut to pale yellowish white, with only a few whiter specks.

2. In the thickness of the shell, the thinner specimens being generally destitute of the band.

3. In the presence or absence of the band.

4. In the size, according to the locality. The small mountain variety has been called a species by the Swiss shell dealers.

It is sometimes distorted—1. by the whorls being reversed; 2. the spire more or less elevated or depressed; 3. very rarely the whorls are elevated and separated from one another. (See *Férus. Hist.* t. 29. f. 1, 2, 3.)

d. *Shell subdiscoidal, above flat, beneath umbilicated; brown, one-coloured; mouth trigonal, edge more or less toothed; periostraca hispid, with long hairs.* (Trigonostoma *Fitz.*)

40. 7. HELIX *obvoluta.* Cheese Snail.—Shell orbiculate, flat umbilicated, bald, reddish brown; spire rather concave; mouth triangular, edge slightly reflexed, with a small tooth on the inside of the lip; lips reddish white. (t. 11. f. 131.)

Planorbis obvolutus. *Poir. Prod.* 89. — Helix obvoluta. *Müller Verm.* 27.; *Lindsay, Trans. Linn. Soc.* 765.; *Forbes and Hanley, B. M.* iv. 63. t. 117. f. 1, 2, 3. — Helix bilabiata. *Oliv. Ad.* 177. — Helix trigonophora. *Lam. Journ. N. H.* t. 42. f. 2. —Helix holosericea. *Gmel.* (not *Studer; Drap. Moll.* t. 7. f. 27. 29.; *Brard, Moll.* 62. t. 2. f. 16, 17.; *Rossm. Icon.* 69. t. 1. f. 21.; *Férus. Hist.* t. 51. f. 4.—Helix (Helicodonta) obvoluta. *Férus. Prod.* n. 107., *Hist.* t. 51. f. 4. — Helicodonta obvoluta. *Risso, Eur. Merid.* iv. 65. — Trigonostoma obvolutum. *Fitz. Syst.* 98. — Gonostoma obvolutum. *Held. Isis*, 1837, 915. — Vortex obvoluta. *Beck, Ind.* 29.

Inhab. shady woods, among the moss near the roots of trees, in Ditcham Wood, near Buriton, Hants. (*Dr. James Lindsay.*) Probably introduced, but is now naturalised.

Animal shagreened, foot grey, neck blackish; tentacles black, upper long, lower very short. (*Sturm*, t. 17.) Jaw moderate, striated in front, crenulated on the edge; epiphragm rather solid, flat, snow-white.

The shells in "living specimens are thickly covered with very fine hairs, which are so extremely brittle as to render it a matter of great difficulty to get the animal out without rubbing them off."

e. *Shell orbicular, depressed, perforated, equally convex on both sides, sharply carinated in its outer circumference; aperture transverse, oval; the peristome united all round, elevated from the other whorls, and margined; epiphragm membranaceous.* (Chilotrema *Leach.* Rock Snail.)

41. 8. HELIX *lapicida.* Variegated Rock Snail.—Shell umbilicate, finely granulate, grey or pale rufous with reddish rays or spots. (t. 5. f. 51.)

Helix lapicida. *Linn. S. N.* 1. 1241.; *Mont. T. B.* 435.; *Drap.* p. 111. t. 7. f. 35—37.; *Brard*, p. 53. t. 2. f. 14, 15.; *Forbes and Hanley, B. M.* iv. 65. t. 116. f. 3, 4.—Carocolla lapicida. *Lamarck*, vi. ii. p. 99.; *Turt. Man.* ed. 1. f. 51.—Latomus lapicida. *Fitz. Syst.* 97.—Helicogona lapicida. *Férus. Prod.* 150. t. 66*, f. 6.; *Risso, Eur. Merid.* iv. 66.—Chilotrema lapicida. *Leach, Moll. Syn.* 77.; *Beck, Ind.* 28.—Helix affinis. *Gmel. S. N.* 3621.—Helix acuta. *Da Costa*, p. 55. t. 4. f. 9.—Lenticula lapicida. *Held. Isis*, 1837, 913.—Helix rhenania. *Hartmann.—List. Conch.* t. 3. f. 4.; *Pet. Gaz.* t. 92. f. 11.

Var. 2. whitish. *Pfeiffer*, 2. f. 27.

In the fissures of limestone rocks, and in woods on a chalky soil.

Animal green or blackish green; neck granular, with two dark streaks; hinder part of the foot yellowish. (*Sturm*, t. 26.) The jaw is strong, with distinct ribs in front and teeth on the edge.

Shell three quarters of an inch in diameter, finely granulated; volutions five, the outer one sloping on both sides so as to form a sharp edge in the middle of the margin, which runs spirally round the upper volutions and marks their separation by a fine line; umbilicus central, large, and deep; aperture oval, with an indenture or small notch on the inside at the outer pointed extremity where the keel commences; the peristome broad, thin, white, reflected, united and detached all round.

Linnæus, from some fancy, called this shell *Lapicida* or stone-cutter.

The shell is liable to some variations in size and colour. It is rarely pale greenish, nearly transparent; it also varies in the distinctness of the brown marbling.

The young shells, as in most other *Helices*, are much more depressed and more strongly keeled.

Dr. Fleming (*Brit. Anim.*) thought that the *Helix cochlea* of Brown (*Wern. Trans.* ii. t. 24. f. 10.) and *H. terebra* Turton (*Conch. Dict.* 161. t. 14. f. 55.) was probably a produced variety of this shell!

f. *Shell depressed, transparent, umbilicated; mouth round; peristome reflexed, continued; epiphragm membranaceous.* (Zurama *Leach.*)

42. 9. HELIX *pulchella.* White Snail. — Shell opaque-white or brownish, depressed, equally convex on both sides; aperture nearly circular, with the margin flat and reflected. (t. 5. f. 49.)

Helix pulchella. *Müller, Verm.* 232. t. 5. f. 49.; *Drap.* p. 112. t. 7. f. 30—32.; *Brard*, p. 56. t. 2. f. 9.; *Alder, M. Z. and B.* ii. 109.; *Gould, Invert. Mass.* 176. f. 102.; *Forbes and Hanley, B. M.* iv. 78. t. 119. f. 8, 9, 10.—Helix paludosa. *Walker, T. M. R.* f. 23.; *Mont.* p. 204.; *Linn. Trans.* viii. p. 193. t. 4. f. 5.—Turbo paludosus. *Dorset Cat.* 52. t. 19. f. 25.; *Turt. Dict.* p. 228.—Turbo helicinus. *Lightfoot, Phil. Trans.* 1786, lxxvi. t. 3. f. 1—4.—Zurama pulchella. *Leach. Moll. Syn.* 78.—Helix minuta. *Say. Jour. Acad. Phil.* i. 123.—Amplexus paludosus. *Brown.*—Amplexus crenellus. *Brown.* Vallonia Rosalia. *Risso, Eur. Merid.*—Lucena pulchella. *Hartmann*, t. 1. f. 6.

Var. 1., more solid, with regular oblique raised transverse striæ: Helix pulchella. *Drap.* p. 112. t. 7. f. 30—32.—Helix crenella. *Mont. T. B.* p. 441. t. 13. f. 3.—Helix costata. *Müller, Verm.* ii. 31.; *Alder, Mag. Z. and B.* ii. 109.—Helix (chilostoma) pulchella. *Charpent. Schweiz. Gess. Nat.* i. 8. 1837.—Helix crystallina. *Dillw. R. S.* ii. 909.—Chilostoma pulchellum. *Fitz. Syst.* 93.—Corneola pulchella. *Held. Isis*, 1837, 912.—Circinaria pulchella. *Beck, Ind.* 23.

Inhab. under stones and on walls, &c.

Animal white or whitish; upper tentacles longish, slender, cylindrical, lower short; eyes black. (*Sturm*, t. 15.) Jaw narrow, striated in front, and minutely crenulated on the edge.

Shell the tenth of an inch in diameter; aperture nearly circular, being very little interrupted by the penultimate volution; the peristome margined and flat; umbilicus large and deep.

The specimens found in marshy damp situations are marked with elevated cross bands, which are the vestiges of former mouths. Those that are found in dry situations, under stones, in shells, &c., are generally destitute of any such ribs.

M. Kickx has proposed once more to separate *H. costata* from *H. pulchella* specifically, on the ground of a difference between the animals. He describes the animal of *H. pulchella* as "milk-white; mantle yellowish; lower tentacles very short;" and *H. costata* as "rufous; mantle violet; lower tentacles scarcely visible." This difference does not exist in the English specimens examined by Mr. Forbes or myself, the animal of both varieties agreeing with the description given above of *H. pulchella.*

This species is also found in North America, according to Férussac.

g. *Shell subglobose, perforated or umbilicated, white or reddish, varied with bands; peristome edged, not spread; periostraca thin, bald; epiphragm membranaceous. Jaw strong, costated in front, and toothed on the edge.* (Heliomanes *Férussac.*)

43. 10. Helix *pisana.* Banded Snail.—Shell subglobose, with the larger volution rather flat at top, marked with numerous brown and yellowish often interrupted bands; the mouth rounded lunate; throat mostly rose-colour. (t. 4. f. 30.)

Helix pisana. *Müller, Verm.* 60.; *Lam. H.* vi. 82.; *Ross. Icon.* vi. 34. f. 359., x. 15. f. 614.; *Forbes and Hanley, B. M.* iv. 56. t. 115. f. 7, 8. — Helix petholata. *Oliv. Z. Ad.* 178. 1792. — Helix cingenda. *Montagu, T. B.* p. 418. t. 24. f. 4; *Linn. Trans.* viii. 195. t. 5. f. 6., xiii. 333. — Helix albina. *Müller, Verm.* (?) 25. — Teba cingenda. *Leach, Moll. Syn.* 67. — Helix zonaria. *Penn. B. Z.* iv. 137. t. 5. f. 133. 1777. (not *Donovan*). Helix rhodostoma. *Drap. Moll.* p. 86. t. 5. f. 13—15. — Helix strigata var. *Dillwyn, R. S.* p. 911. — Theba pisana. *Risso, Eur. Merid.* iv. 73. — Helix albella. *Fleming, B. A.* 260. (immature). — Helix alboramensis. *Webb and Berth. Canar.* — Xerophila pisana. *Held. Isis*, 1837, 96. — Euparypha rhodostoma. *Hartm.* i. 204. t. 79, 80. — Carocolla maculata. *Menke, Syn.* 25.

Inhab. dry sandy places near the sea.

Animal yellowish white; neck purplish; tentacles long, club-shaped.

Shell about half an inch in diameter, and not so much high, with the volutions a little flattened at top, slightly striate; colour whitish or yellowish, rarely without coloured bands, but mostly with seven or eight brown circular lines on the lower volution, often broken into dots; the tip black; these bands are very variable; aperture longer than wide, with the margin thin and reflected at the pillar, where it half closes the narrow but deep umbilicus; the region of the mouth is generally of a more or less intense rose-colour.

It varies greatly in the distinctness, the strength, and the disposition of the bands: sometimes they are altogether wanting, and at others (rarely) suffused over the surface. It also varies in the colour of the throat, which is generally rose-coloured, but sometimes pure white; also greatly in size, according to the situation; and also in form, varying from subglobose to subconic, or depressed, as in other species

of the genus; and monstrosities are sometimes found with the whorls reversed, and more or less produced.

It is one of the most beautiful of our snails, and extremely local. It is common in the south of Europe and Northern Africa; but it is not found in the northern countries: Wales may be considered its northern limit.

Mr. Jeffreys believes the beautiful pink gloss observed on the mouths of this and *H. virgata* to be entirely owing to the action of, and exposure to, the sun; for, in the specimens found in more sheltered situations, the colours and marking are much fainter, and sometimes altogether wanting. (*Linn. Trans.* xvi. 334.) It most probably arises from the animal being in better health in sunny places, as it is most like the warmer climate in which they appear to delight, beyond the confines of which our specimens are living.

According to Montagu, it is one of our most rare species. He only found it in one place, on the sand to the west of Tenby, where it is confined to a small spot. Mr. Racket has found it at St. Ives, in Cornwall. It has also been said to be found near Dublin.

England is probably the northern limit of this species, which is not found in Germany or Sweden.

44. 11. Helix *fasciolata*. Black-tipped Snail.—Shell flattish, yellowish, with brown interrupted bands and spots, and strongly striated concentrically; umbilicus moderate; mouth white. (t. 4. f. 32.)

Helix caperata. *Montagu, T. B.* p. 433. t. 11. f. 11. (1803); *Turton, Man.* ed. 1. 42. f. 32.; *Jeffreys, Linn. Trans.* xvi.

335.; *Forbes and Hanley*, *B. M.* iv. 59. t. 117. f. 7. — Teba caperata. *Leach*, *Moll. Syn.* 70. — Helix striata. *Drap. Tabl.* 91. (1801, *June*), *Hist.* p. 106. t. 6. f. 18—21., not *Müller; Ross. Icon.* vi. 28. f. 354. — Helix intersecta. *Poiret*, *Coq. Aisne*, 81.; *Brard*, *Moll. Paris*, p. 39. t. 2. f. 7. — Helix crenulata. *Dillwyn*, p. 895. — Xerophila striata. *Held. Isis*, 1837, 913. — Theba intersecta. *Beck*, *Ind.* 12. — Helix fasciolata. *Poiret*, *Prod.* 79. 1801 (*April*); *Moq. Tand. Moll. Fran.* ii. 239. t. 18. f. 7—10. — Helix cinerea. *Poiret*, *Prod.* 73. (?) — Helix strigata. *Studer*, *Syst.* 87. — Helix tergestina. *Ross. Icon.* f. 554. — Helix obesa and H. pullula. *Ziegler.* — Helix ornata. *Picard*, *Moll. Som.* 230. — Helix Gigaxii. *Charpent.*

On dry banks, and under stones in hilly places, especially near the sea.

Animal yellowish ash, warty above, foot thickish.

Shell seldom half an inch in diameter, and a quarter of an inch high, rather depressed; the larger volution sloping to a somewhat carinate edge in the middle, with regular deep transverse striæ; colour dull yellowish white, with regular brown bands, which are often interrupted, and the tip black; aperture crescent-shaped, as long as it is broad, with the margin thin and not reflected over the umbilicus, which is large and deep.

Like the preceding, it is equally liable to vary in size, colour, and form, and offers nearly the same variations. It is immediately known from that species by being more depressed, and strongly concentrically striated.

Mr. Alder observes that he has not seen any British variety of this shell similar to *H. candidula* Studer, referred to by Mr. Jeffreys.

In the former edition of the work I gave precedence to the names of Colonel Montagu over those of M. Draparnaud, not being aware that his

"Tableau," published in 1801, contains any characters, never having seen the work. This is excusable, as the Abbé Dupery very properly observes, "Elle est d'autant moins étonnante chez un étranger, que, même en France, le petit volume de Draparnaud, devenu fort rare, est inconnu d'un grand nombre de naturalistes, et qu'il n'a été, jusqu'à présent que très-rarement cité par nos auteurs francais" (Preface, xiii.); and the claim to priority is not very strong, for M. Moquin Tandon, in speaking of the "Prodromus" of Poiret, and the "Tableau" of Draparnaud, observes,—"On remarque déjà, dans l'un et l'autre livre, quelles distinctions spécifiques ne sont plus aussi tranchées que dans le petit traité de Geoffroy;" so the books are not to be compared to the elaborate work, accompanied by good figures, of Montagu.

M. Moquin Tandon has shown that Poiret's name has precedence, by a few months, of that used by M. Draparnaud, as his has over Montagu's. (*Moll. Franc.* ii. 239.)

45. 12. HELIX *virgata*. Zoned Snail.—Shell somewhat globular, white, with from one to six brown bands more or less interrupted; the mouth dull rufous; umbilicus moderate. (t. 4. f. 31.)

Helix virgata. *Montagu*, p. 415. t. 24. f. 1.; *Petiver*, *Gaz.* t. 17. f. 6.; *Turton*, *Man.* ed. 1. 40. f. 31.; *Forbes and Hanley*, *B. M.* iv. 57. t. 117. f. 10.—Cochlea virgata. *Da Costa*, *B. C.* 79. t. 4. f. 7. 1778.—Teba virgata. *Leach*, *Moll. Syn.* 68.—Helix variabilis. *Drap. Tabl.* 73. 1801, *Hist.* p. 84. t. 5. f. 11, 12.; *Férussac*, *Journ. Phys.* 297.; *Rossm. Icon.* t. 26. f. 356. *a.* f.; *Moq. Tand. Moll. Franc.* ii. 262. t. 19. f. 21—26.—Helix striata. *Brard*, *Coq. Paris*, p. 36. t. 2. f. 5, 6.—Helix

zonaria. *Donovan*, ii. tab. 65. 1800. — Helix zonaria var. *Penn. B. Z.* iv. 137. t. 85. f. 133. *a.*—Helix pisana. *Dillwyn*, p. 911.—Helix subalbida. *Poir. Prod.* 83.—Helix ericetorum *Chemn. C. C.* ix. 1194, 1195. — Xerophila variabilis and X. Treversii. *Held. Isis*, 1837, 917. — Theba virgata and T. Treversii. *Beck*, *Ind.* 14. — Helix monilifera. *Menke*, *Syn.* 22. — Helix Treversii. *Michaud*, *Moll. France*, 26. t. 14. f. 20, 21.; *Ross. Icon.* ix. f. 565.—Helix elegans. *Wern. Trans.* vi. 524. t. 24. f. 9. (not *Drap.*). — Helix disjuncta. *Turton*, *Conch. Dict.* 61. f. 63. — Helix istriensis. *Ziegl.*

On short grass, on sandy plains, especially about the sea-coasts. (*Petiver* as *Heath Shells.*)

Animal purplish-ash; foot thick, yellowish.

Shell about half an inch in diameter, and nearly as much high, usually white with a single dark brown band in the middle of the larger volution, and several irregular ones at the base; but subject to infinite variations from the presence or absence or confluence of the bands, the most singular of which is that of a dark brown with a single white band, and that of a pure opaque white with transparent white bands, the tip generally black; about the mouth and pillar dull rufous; aperture longer than broad, the margin thin and reflected at the umbilicus, which is small and deep.

When young, the larger volution slopes to a somewhat carinated edge.

Varies greatly in size, being sometimes three fourths of an inch in diameter, and at others not one third of that size; in colour, being sometimes pellucid white and bandless, and generally opaque and very distinctly banded; and, from the number of its bands, it offers an almost endless variety of banding: sometimes the colouring which forms the bands is suffused over

the whole shell, making it brown, or even nearly black. Also sometimes in shape, and more or less in the elevation and depression of the spire, and in the size of the umbilicus. From its abundance, it is very liable to the usual distortions: thus some are found with the whorls reversed, or more commonly produced out of their usual course. It was a specimen of this monstrosity that was called *Helix elegans* by Brown, and *H. disjuncta* by Turton.

Mr. Alder says that a very small variety of this shell is found on the coast of North Devon, which is probably the *Helix maritima* of Draparnaud. I have not been able to see this variety. It is also referred to by Jeffreys (*Linn. Trans.* xiii. 335.); but the continental authors do not mix them together.

In the autumn these shells are often suddenly observed in such great numbers as to give rise to the popular notion of their having fallen from the clouds; and in very hot weather the young both of this species and the *H. pisana* may be found in clusters adhering to the stalks of various plants, with the aperture closed by a thin pellicle (*epiphragm*), except where it is in contact with the plant.

This shell is very hardy, and appears nearly insensible to cold, as it does not hybernate even when the ground is covered with snow.

There has been considerable discussion respecting the name of this shell; but there can be no doubt Da Costa's name, also used by Montagu, has the priority. Draparnaud's name has been preferred because it was shortly characterised by him in his "Tableau" (1801) printed one year before Montagu;

others have preferred Donovan's name, printed in 1800; but it is not the *H. zonaria* of Linnæus.

M. Moquin erroneously refers *H. virgata* of Da Costa to *H. pisana;* Da Costa specially described our common heath snail, and not the Welsh one.

46. 13. HELIX *ericetorum.* Heath Snail. — Shell depressed, semitransparent, grey or brownish, and generally banded; aperture roundish; umbilicus very large and deep. (t. 4. f. 37.)

Helix ericetorum. *Müller, Verm.* ii. 226. var. *a.*; 1774, *Petiver, Gaz.* t. 93. f. 18. — Helix itala. *Linn. S. N.* 1245. *fide type; Montagu,* p. 437. t. 24. f. 2.; *Turton, Man.* ed. 1. 54. f. 37.; *Brard, Coq. Paris,* p. 45. t. 2. f. 8.; *Forbes and Hanley, B. M.* iv. 61. t. 117. f. 4. — Zonites ericetorum. *Leach, Moll. Syn.* 73. — Helix cespitum, b. *Drap.* p. 109. t. 6. f. 16, 17.; *Pfeiffer,* 39. t. 2. f. 24, 25. — Helix erica. *Da Costa,* p. 58. t. 4. f. 8. 1778. — Helix albella. *Penn. B. Z.* iv. 132. t. 35. f. 122. 1779. — Helix striata. *Müller, Verm.* 38., dead. — Helix nivea. *Gmelin, S. N.* 3639., dead. — Oxychilus ericetorum. *Fitz. Syst.* 100. — Helicella ericetorum. *Risso, E. M.* iv.—Theba ericetorum. *Beck. Ind.* 13. — Xerophila ericetorum. *Held. Isis,* 1837, 913. — Helix dubia, and H. neglecta. *Hartmann.*

On dry heaths and downs, on the stalks of the larger plants; on chalky soil near the sea.

Animal greenish-white; foot slender, pellucid. (*Sturm, Fauna,* t. 24.)

Shell nearly an inch in diameter, much depressed at top, slightly striolate, of a grey or rusty-brown colour, with generally a brown band above, continuing round the edge of the smaller volutions; sometimes the bands are so obliterated as to be hardly visible; aperture nearly orbicular, not much interrupted by the penultimate volution, longer than

broad, the peristome very thin and not reflected; umbilicus very large, and so open and deep as to expose three or four of the volutions.

This shell varies greatly in colour, being often distinctly banded, and at other times quite bandless, when it is *H. obliterata* of Hartmann. The bands vary in number, those on the front of the whorls being most generally present. It also varies very much in size, being sometimes an inch in diameter (see *Pfeiffer*, t. 2. f. 24, 25.), and at others not one third of that size (*Pfeiffer*, t. 2. f. 23.), when full grown; the smaller shells are always rather thicker. It is always known from *H. cespitum* of Draparn. by the spire being lower and the umbilicus wider. Mr. Jeffreys speaks of one with a more produced spire found in Iona, Western Islands (*Linn. Trans.* xiii. 339.); but I have not seen any that agree with Draparnaud's species.

h. *Shell depressed, perforated or umbilicated, horn-coloured or brown, nearly one-coloured; peristome slightly thickened, rather spread; periostraca pale, often bristly, especially in the young; bristles deciduous. Jaw broad, costated in front, and toothed on the edges.* (Hygromanes *Férussac.*)

47. 14. HELIX *cantiana.* Kentish Snail. — Shell slightly depressed, subglobose, brittle, semi-transparent, pale rosy, with an obscure paler band; region of the aperture rufous-brown; umbilicus small. (t. 3. f. 26.)

Helix cantiana. *Montagu*, p. 422. t. 23. f. 1. 1803; *Maton and Racket, Linn. Trans.* viii. 197.; *Fér. Prod.* 43.; *Forbes and*

*Hanley, B. M.* iv. 50. t. 116. f. 8, 9.—Teba cantiana. *Leach, Moll. Syn.* 68.—Theba carthusiana. *Risso, Eur. Merid.* iv. 74.—Helix carthusiana. *Drap.* p. 102. t. 6. f. 33. (?), 1801; *Turton, Man.* ed. 1. f. 26.; *Brard,* p. 24. t. 1. f. 6., not *Müller; Férus. Prod.* 43.; *Rossm. Icon.* vi. f. 364.—Helix pallida. *Don. Br. Shell.* t. 157. f. 2. (1802).—? Helix crepuscularis. *Gmel. S. N.*—Fruticola carthusiana. *Held. Isis,* 1817, 914.—Bradybæna cantiana, and B. brunonensis. *Beck, Ind.* 19.

In hedges in sandy and chalky districts. Kent, Surrey, Hampshire, Dorset, Hertford. Now common near Newcastle.

Animal grey, above warty, brown.

Shell about three quarters of an inch in diameter, irregularly striate transversely, thin and nearly transparent, of a pale yellowish-white or lead-colour, rufous about the mouth and underneath; the lower volution tumid and well rounded, not carinated, but mostly marked with an obscure pale band in the middle; aperture semielliptic, as wide as long, with a thin but not reflected margin; the internal rib white or rosy; umbilicus small. (fig. 35.)

*Fig.* 35.

The young shells are very pale, pellucid, and with a rather hispid periostraca.

Férussac was at first inclined to consider this species as distinct from any of the continental shells (*Journ. Phys.* xc. 300.); but he afterwards considered it as a local variety of *H. carthusiana* of Drap. All the French specimens I have seen are very different from our shells, and I think they want further examination; at any rate Lister's and Montagu's names have the priority, and *H. carthusiana*

was used by Müller for another species, for which it should be retained.

*Helix cantiana* has been supposed to be almost confined to the four metropolitan counties, but it is also found in Suffolk, near Bristol, and near Dublin. It may have been introduced in these latter localities; for it has been within these few years, according to Mr. Fryer, introduced with ballast by the colliers on the banks of the Tyne, and is now rapidly spreading itself in the hedges of that neighbourhood. These circumstances would lead one to imagine that it might also have been introduced into England from the Continent; but Férussac, who has compared it with the continental species, regards it at least as a local variety of *H. carthusiana* of Draparnaud (not of Müller), which is a native of the south of France and Italy.

48. 15. HELIX *carthusiana*. Gibbs's Snail. — Shell depressed, semitransparent, bald, rather shining, grey, with a milk-white band across the aperture externally; umbilicus minute. (t. 3. f. 27.)

Helix carthusiana. *Müller*, *Verm.* 15., not *Drap.*; *Pfeiffer*, *Helix*, i. 132.; *Forbes and Hanley*, *B. M.* iv. 51. t. 116. f. 5, 6. — Helix carthusianella. *Drap.* p. 101. t. 6. f. 31, 32. and t. 7. f. 3, 4.; *Brard*, p. 24. t. 1. f. 7.; *Turt. Man.* ed. 1. f. 27. *Ross. Icon.* vi. f. 366. — Teba carthusianella. *Leach*, *Moll. Syn.* 69. t. 8. f. 4—6. — Helix (Zenobia) bimarginata. *Gray*, *Med. Rep.* 1821. — Helix Gibbsii. *Montagu*, *MSS.* "*Leach*," *Brown*, *Brit. Shells.* t. 40. f. 49. 51. — Helix nitida. *Chemn. C. Cab.* ix. 103. t. 127. f. 1130, 1131. — Helix nemoralis β3. *Gmelin S. N.* — Helix Gypsii. *Férus. Jour. Phys.* xc. 300. (for Gibbsii.) — Helix Olivieri var. γ. *Férus. Prod.* 255. — Theba Charpentieri and Th. carthusianella. *Risso*, *Eur. M.* iv. 76. — Monacha carthusianella. *Fitz. Syst.* 95.

—Fruticola carthusianella. *Held. Isis*, 1837, 914. —Bradybæna carthusiana. *Beck, Ind.* 19.
Var. smaller, rather more convex.
Var. thinner, t. 11. f. 27*. : Helix rufilabris. *Jeffreys, Linn. Trans.* xvi. 509.

On stunted grass, on the Downs in the chalky districts of Kent and Sussex, near the sea. (*Mr. Gibbs*, 1814.)

Animal grey above, yellowish below; tentacles long, flexible.

Shell not half an inch in diameter, more depressed than the last, and not so glossy, without the rufous stain about the mouth and underneath; aperture more narrowed; and the umbilicus very minute; on the outside of the aperture is a milk-white transverse band. (fig. 36.)

*Fig.* 36.

This species varies considerably in size, in the thickness and the opacity of the shell, and in the distinctness of the double band round the mouth, the white band being most indistinct in the thinner specimens.

Mr. Jeffreys thinks it probable that this species had been introduced from France (*Linn. Trans.* 509.); but I have seen it quite as common as *H. virgata* for many miles of the south coast of England, from Dover to Portsmouth; and it must have been introduced, if at all, some years ago, as it was discovered by Mr. Gibbs in 1814, and is now very generally distributed in the neighbourhood of the sea coast, like many other *Helices* allied to it, which are believed to be natives.

49. 16. HELIX *fusca*. Brown Snail. — Shell subglobose, wrinkled, transparent, very brittle, rather flexible, amber-coloured, bald; aperture lunate; umbilicus very narrow; peristome thin. (t. 4. f. 36.)

Helix fusca. *Mont.* p. 424. t. 13. f. 1.; *Turt. Dict.* p. 946. *Man.* f. 36.; *Jeffreys, Linn. Trans.* xvi. 321. 391. 507.; *Alder, Mag. Z. and B.* ii. 107.; *Pfeiffer, Mon. Hel.* i. 32. *Forbes and Hanley, B. M.* iv. 77. t. 119. f. 45. t. G G G. f. 4. t. 132. f. 10.—Zonites fuscus. *Macgilliv. Moll. Aberd.* 93.—Helix revelata. *Bouch. Moll. Pay. de Cal.* 44., not *Férussac.* —Helix subrufescens. *Miller, Ann. Phil.* iii. 379. 1822. —Helix (Zenobia) corrugata. *Gray, Med. Rep.* 1821, 239.

Inhab. damp woods among decayed leaves and thick herbage, and on the under side of the leaves of alders, &c.

Animal yellowish; tentacles long.

*Fig.* 37.

Shell three eighths of an inch in diameter, and a quarter of an inch high, very thin and pellucid, more or less wrinkled, glossy amber-coloured; aperture crescent-shaped, very thin, as long as broad, reflected only at the pillar-angle, where there is a minute perforation. (fig. 37.)

50. 17. HELIX *rufescens*. Rufous Snail. — Shell flattish, bald, reddish horn-colour, concentrically striate, slightly carinated by a narrow central paler band; whorls six; mouth roundish lunate; umbilicus large and deep. (t. 11. f. 28.; t. 3. f. 22. 28*.)

Helix clandestina. *Born. Mus. Vend.* — Helix rufescens. *Penn. B. Z.* f. 34.; *Montagu*, p. 420. t. 23. f. 2.; *Fér. Prod.* 44.; *Turton, Man.* ed. 1. 37. f. 28.; *Jeffreys, L. T.* xiii. 337. *Forbes and Hanley, B. Moll.* iv. 68. t. 118. f. 4. 7. —Teba rufescens. *Leach, Moll. Syn.* 70. — Helix glabella.

*Drap.* p. 102. t. 7. f. 6.; *Fér. Prod.* 43.; *Alder, Mag. Z. and B.* iii. 107. — ? Helix turturum. *Gmelin, S. N.* — Helix Altenana. *Kless. Test. Tubing.* — Helix corrugata and H. clandestina. *Hartm. N. Alp.* p. 256. — Helix montana. *C. Pfeiffer, D. Moll.* iii. 3. t. 6. f. 10. — Helix circinata, H. cælata and C. montana. *Studer, Schw. Conch.* 12.; *Ross. Icon.* t. 63. f. 10.—Fruticola circinata. *Held. Isis*, 1837, 914. — Bradybæna rufescens and B. circinata and B. cælata. *Beck, Ind.* 20. — Helix striolata. *C. Pfeiffer, D. Moll.* iii. 28. t. 6. f. 8. — Helix rufina. *Parreys*, in *Pfeiff. Symb.* i. 39. — Helix Parreysi. *Fitz. Verz.*

Inhab. gardens and hedges.

Animal black-grey; upper tentacles thick.

Shell growing to three quarters of an inch in diameter, but often smaller, semitransparent, varying from pale ash-colour to rufous brown, often marbled and mottled with paler or darker blotches, rarely pure white, slightly carinate in the middle of the larger volution by a paler band; aperture semielliptic, thin, and slightly reflected, longer than broad. Both the young and old shells are quite bald. (fig. 38.)

*Fig.* 38.

Montagu, and all who have copied from him, have represented the young of this species as clothed with hairs. He probably mistook the *Helix hispida* for it.

Lister gives some details of the anatomy of this species (*Anat.* t. 4. f. 4.).

The shell varies greatly in colour, being generally reddish brown, but passing from that colour to nearly transparent or translucent white; and in shape and size. Tab. 4. f. 36., which Dr. Turton, in the first edition, gave for *H. fusca*, appears to represent a small higher variety of this species, which is often met with near Battersea.

51. 18. Helix *depilata*. Bald Snail. — Shell somewhat globular, depressed, pale, bald; whorls rounded, concentrically grooved; mouth lunate; peristome thickened, white; umbilicus moderate. (t. 11. f. 135*.)

Helix depilata. *Pfeiffer*, i. 33. t. 2. f. 18. (?); *Alder*, *Mag. Zool. and Bot.* ii. 107.

Inhab. hedges and wet places.

This species is very like the former, but quite destitute of hairs in all its stages; it is much smaller in all its parts than any of the varieties of *H. rufescens*.

Mr. Alder states that his specimens agreed perfectly with those of Pfeiffer in Férussac's cabinet; Mr. Jeffreys refers to Pfeiffer's figures with doubt, as representing *H. concinna;* and Mr. Alder says it is not to be distinguished from it except by its not being hispid in any of its stages. Rossmässler regards *H. depilata* of Jeffreys as the same as *H. sericea* and *H. glabella*, and refers Turton's figure of *H. granulata* to this species!

52. 19. Helix *granulata*. Granular Snail. — Shell somewhat globular, transparent, rather shining, yellowish horn-colour, closely hairy, with nearly six tumid volutions; mouth roundish lunate; umbilicus very small. (t. 3. f. 29.)

Helix granulata. *Alder*, *Cat.* 107. — Helix sericea. *Drap. Moll. Franc.* 103. t. 7. f. 16, 17.; *Turton*, *Man.* ed. 1. 38. f. 29.; *Jeffreys*, *Linn. Trans.* xvi. 333. and *Pfeiffer*, *Mon. Hel.* i. 145; *Forbes and Hanley*, *B. M.* iv. 71—289. t. 118. f. 5, 6. t. 132. f. 9.; *Ross. Icon.* vii. 2. f. 248. 429. — Helix hispida. *Montagu*, t. 23. f. 3.; *Linn. Trans.* viii. 198. — Teba hispida. *Leach*, *Syn. Moll.* — Helix globularis.

*Jeffreys*, *Linn. Trans.* xvi. 507. — Monacha sericea. *Filz. Syst.* 95. — Fruticola sericea. *Held. Isis*, 1837, 914.

Inhab. moist woods and hedge banks.

Animal pale yellowish white; head and tentacles grey; mantle beautifully speckled with black, the black blotches being larger towards the upper extremity, and giving the higher whorls of the shell a mottled appearance when alive; the foot is short and thick.

Shell a quarter of an inch in diameter, and as much high, pale horn-colour, frequently a little rufous about the mouth, extremely thin and light, clothed with a very fine down enlarged at the base, which, when worn off, leaves the surface glossy and minutely granulate like shagreen; aperture crescent-shaped, rather wider than long, very thin, and reflected only at the umbilicus, which is extremely small. The larger volution is well rounded, without keel or band, and the internal rib only visible in full-grown specimens.

This is evidently not the *H. hispida* of the continental writers, nor the *H. sericea* of Müller or Draparnaud.

53. 20. HELIX *sericea*. Silky Snail. — Shell rather globular, thin, transparent, reddish horn-coloured, nearly smooth, or slightly wrinkled, with six whorls thickly set with soft recurved hairs; outer lip thin, without any ribs; umbilicus small. (t. 11. f. 134.)

Helix sericea. *Pfeiffer*, *D. Moll.* i. 34. t. 2. f. 17.; *Kenyon Mag. N. H.* t. 427. f. 3.; *Alder*, *Mag. Zool. and Bot.* ii. 107., not *Turton*, *Man.* ed. 1. — Helix hispida, var. *Forbes*,

*and Hanley, B. M.* iv. 69. — Helix hispida. *Gilbertson, MSS. B.M.*

Inhab. woods (?), north of England.

Animal greyish, marbled with black.

Shell subglobular, three tenths of an inch in diameter, dark brown, thin, pellucid, with a very obscure whitish central band, giving it a rather keeled appearance, covered with a brown periostraca with distant elongated hairs; umbilicus rather small (partly covered with the front of the lip), only showing the last whorl but one.

Mr. Alder, who first noticed this species in England, observes, "It is difficult to say whether or not this is the *H. sericea* of Müller, I having introduced it as such on the faith of Baron de Férussac. I leave it for further investigation."

*Fig.* 39.

This shell varies from dull reddish to nearly pure translucid white.

Mr. Kenyon gave the accompanying figure as *H. sericea* of Draparnaud. (fig. 39.)

This shell is thinner, more globular, and with the umbilicus smaller than *H. hispida;* of a darker colour, and with the apex more depressed than *H. granulata.*

54. 21. Helix *hispida.* Bristly Snail. — Shell slightly convex, a little carinate, striolate, transparent, horn-coloured; periostraca hairy, with crowded bristles; umbilicus moderate, deep; mouth roundish lunate. (t. 4. f. 41.)

Helix hispida. *Müller, Verm.* 73.; *Turton, Man.* ed. 1. 57. f. 41 ; *Drap.* p. 103. t. 7. f. 20. 22.; *Brard,* p. 27. t. 2. f. 1.; *Jeffreys, Linn. Trans.* xiii. 338.; not *Montagu; Forbes and Hanley, B. M.* iv. 68. t. 118. f. 1, 2, 3. t. G G G. — Teba

hispida. *Leach, Moll. Syn.* 71. — Helix rufescens jun. *Mont. T. B.* supp. 145. t. 23. f. 2. inner. — Helicella hispida. *Fitz. Syst.* 96. — Fruticola hispida. *Held. Isis*, 1837, 914. — Bradybæna hispida. *Beck, Ind.* 20.

Inhab. woods, under stones, in shady places.

Animal grey, foot white, thick; tentacles very slender, dark.

Shell about a quarter of an inch in breadth, and hardly as much high, horn-coloured, with a slight paler band in the middle of the larger volution; periostraca clothed with close fine hairs which are very caducous, under which it is a little striate, but not granular, like the *H. granulata;* aperture moderate. (fig. 40.)

*Fig.* 40.

55. 22. HELIX *concinna.* Neat Snail.—Shell rather depressed, slightly keeled, rather shining, reddish brown, concentrically grooved, with scattered deciduous whitish hairs; whorls five or six; mouth roundish lunate, margined; umbilicus broad. (t. 11. f. 135.)

Helix concinna. *Jeffreys, Linn. Trans.* xiii. 337.; *Alder, Mag. Z. and B.* 107. — Helix hispida, var. *Forbes and Hanley, B. M.* iv. 69. — Helix depilata. *Pfeiffer*, i. t. 35., t. 2. f. 18. (?); *Alder, Mag. Z. and B.* 107. — Helix rufescens. *Swiss Conchologists.*

Inhab. under stones, and dry places, among nettles, &c.

Animal reddish, very polished; tentacles longish.

Shell very like the former, but differs in being rather larger, the umbilicus wider, and the hairs further apart and much more deciduous, which

makes it often appear smooth, except near the sutures and umbilicus.

Mr. Jeffreys, after examining many hundred specimens from different localities, is inclined to think that it must be referred to *H. hispida*. (*Linn. Trans.* xiii. 510.)

Mr. Alder observes that this may be a variety of *H. hispida*, as was supposed by Mr. Jeffreys, but is stronger, and with the hairs more deciduous, than the usual form of that species. It is very generally diffused, commonly taking the place of *Helix glabella* (*H. rufescens*) in situations where the latter is not found. (*Alder, Mag. Z. and B.* ii. 107.)

Mr. Alder also refers to *H. circinata* of Férussac, which Rossmässler regards as a distinct species.

I do not think the four last species are satisfactorily determined; they may be only varieties of one another, or there may be more species; but this can only be determined by collecting together a very large number of specimens from their natural situations (not as collected among the rejectamenta of rivers), observing how the specimens of the same locality or brood vary, and how the periostraca and the hairiness is affected by their being kept alive, and also by the kind of place they may inhabit. The synonyma of the foreign authors are even more doubtful; but this is occasioned by our seldom receiving the same species or variety of these hairy *Hydromanes* under the same name, from our foreign correspondents and the dealers. Indeed the foreign species, judging from the very different synonyma of the continental authors, are as confused as our own.

56. 23. HELIX *revelata*. Green Snail. — Shell orbicular, subglobose, thin, finely wrinkled, umbilicated, diaphanous, shining pale green, with a few scattered hairs; whorls convex, last largest; peristome thin. (t. 11. f. 133.)

Helix revelata. *Férussac, Prod.* 44. (?); *Michel, Compl.* 27. t. 15. f. 6, 7, 8.; *Forbes and Hanley, B. M.* iv. 70. t. 119. f. 1, 2, 3.; *Benson, Ann. and Mag. N. H.* 1848, ii. 359. (not *Bouchard*).— Helix badiella. *Ziegler.*— Helicella revelata. *Beck, Ind.* 7. — Helix subviridis. *Bellamy, British Assoc.* 1841, *South Devon.*

Inhabits shady places, among nettles. Devon, Cornwall, Nottingham.

Animal blackish.

Shell thin, nearly transparent, green; the mouth large, roundish lunate, very oblique; the umbilicus rather narrow, only showing the penultimate whorl; the peristome is thin, and very slightly reflexed. Most like *H. fusca*, but not so thin, and smooth, green, and umbilicated. The hairs are brittle and deciduous in the dry specimens.

57. 24. HELIX *aculeata*. Prickly Snail. — Shell conical, globose, brown horn-colour, with the suture deep; the periostraca rising into thin spinous foliations; aperture semielliptic. (t. 4. f. 33.)

Helix spinulosa. *Lightf. Phil. Trans.* lxxvi. 166. t. 2. f. 1—5.; *Montagu*, p. 449. t. 11. f. 10.; *Linn. Trans.* viii. 201. — Teba spinulosa. *Leach, Moll. Syn.* 72. — Helix aculeata. *Müller, Verm.* ii. 81.; *Drap.* p. 82. t. 7. f. 10, 11.; *Alder, Cat.* 109.; *Ross. Icon.* viii. f. 536.; *Forbes and Hanley, B. M.* iv. 74. t. 117. f. 5, 6. — Helix delectabilis. *Solander, MSS.* — Trochus terrestris, var. *Da Costa, B. C.* 36. (?) — Teba Granatelli. *Bivon*, in *Occhio*, 1839, n. 9. f. 2. — Fruticola aculeata. *Held. Isis*, 1837, 914.

Inhab. woods, under leaves and stones.

Animal greenish; tentacles long.

Shell about the tenth of an inch wide, and as much high, thin, semitransparent, brown horn-colour; the volutions rounded and deeply separated, clothed with a thin periostraca, which rises into numerous regular rather oblique foliations shooting into points, exhibiting the appearance of a circle of bristles round the middle of each; aperture somewhat orbicular, as long as wide, with a white rib on the inside; umbilicus moderately large and deep.

According to the observations of Mr. Jeffreys, this animal feeds on the *Jungermannia platyphylla*. It has a very extended range; for it is found in the north of Sweden.

58. 25. HELIX *lamellata*. Scarborough Snail.—Shell somewhat trochiform, grey; the periostraca rising into close-set equal longitudinal lamellæ; whorls six, gradually increasing in size; mouth lunate; umbilicus deep. (t. 5. f. 48.)

Helix scarburgensis. *Bean, MSS.*, in *Alder, Cat.* 109., *Turton, Man.* 162., *Müller, Wiegm. Arch. N.* 1838, 208. t. 4. f. 4.; *Ross. Icon.* viii. f. 37.—Helix holosericea. *Miller, MSS.* — Helix lamellata. *Jeffreys, Linn. Trans.* xvi. 333., not H. lamellosa, *Férussac; Pfeiff. Mon. Hel.* i. 51.; *Forbes and Hanley, B. M.* iv. 73. t. 117. f. 8, 9.— Helix Seminulum. *Ross. Icon.* f. 533.

Inhab. woods, north of England — Scarborough (*Bean*), Newcastle (*Alder*).

Animal pale grey.

Shell the tenth of an inch in diameter, and as much high, grey or pale horn-colour, semitransparent,

pyramidal, with very numerous regular longitudinal lamellæ not shooting in the middle into spinous projections; spire composed of six rounded and deeply divided volutions, which very gradually decrease from the tumid and rounded base; the tip obtuse and usually of a whitish colour; aperture narrow crescent-shaped, wider than long, the margin thin and reflected over the umbilicus, which is small and deep.

Like that of *H. aculeata*, the periostracum of this species rises into thin laminar foliations, which in various positions of light reflect a velvety or satin-like lustre; but the foliations are infinitely more numerous and compact, not shooting into spinous processes in the middle; the shape of the spire is also very different, not decreasing in a conical manner, but regularly pyramidal; and the aperture, instead of projecting forward in a semielliptic form, is narrow crescent-shaped, without the internal rib round the margin.

i. *Shell depressed, more or less keeled, brown or varied, striated; whorl closely applied; peristome simple, slightly depressed; jaws slender, striated and crenulated.* (Delomphalus *Férus.*)

59. 26. HELIX *rotundata.* Radiated Snail. — Shell flattish, slightly carinate, deeply striate, rufous-grey with chestnut spots. (t. 5. f. 44.)

Helix (Delomphalus) rotundata. *Charpent*, 1837. — Helix radiata. *Da Costa*, p. 57. t. 4. f. 15, 16.; *Montagu*, p. 431. t. 24. f. 3.; *Turton, Man* ed. 1. 59. f. 44. — Helix rotundata. *Müller*, 29.; *Drap.* p. 114. t. 8. f. 5—7.; *Brard*, p. 51. t. 2. f. 10, 11.; *Jeffreys, L. T.* xiii. 342.; *Rossm. Icon.* vii. f. 454.; *Forbes and Hanley, B. M.* iv. 80. t. 119. f. 6, 7. t. G G G.

f. 2.; *Moquin Tandon*, ii. 107. t. 10. f. 9—12. — Zonites radiatus. *Leach*, *Moll. Syn.* 74. — Helix perspectiva. *Megerl*, *Berl. Mag.* — Discus rotundatus. *Fitz. Syst.* 99. — Patula rotundata. *Held. Isis*, 1837. 916. — Euryomphala rotundata. *Beck*, *Ind.* 9.

Var. b., spire quite flattened: Helix Turtoni. *Fleming*, *Brit. Anim.* 269. — Helix albella. *Linn. S. Nat.* — Helix rotundata. *Turton*, *Dict.* p. 53.

Var. c., white, transparent, and without rays: Zonites rotundatus. *Gray*, *Man.* 165. t. 5. f. 44.

Common under stones and wood, on dead trees, and in crevices of old walls.

Animal pale grey, dotted above; foot short, hyaline; back, head, and tentacles blackish (*Sturm*); jaw slender, striated, and crenulated; teeth are those of a true *Helix*.

Shell about a quarter of an inch in diameter, nearly equally convex on both sides, slightly carinate, strongly and regularly striate across, yellowish or reddish-grey with chestnut rays from the centre; aperture semilunar, as wide as long, thin and not reflected; umbilicus large and deep.

This species varies in size and in form, especially of the spire, which is sometimes rather convex, and at others nearly flat: in the latter form, it has been considered as a separate species; and Nilson believes that the shell which Linnæus described as *Helix albella* in his "Swedish Fauna," is only a young species of the flat-spired variety of this shell. It also varies in the intensity of the brown spots on the spire; sometimes they are diffused and at others entirely wanting, and the shell is sometimes nearly transparent and colourless.

The jaw of *Helix pygmea* (*Moq. Tand.* t. 10. f. 2.),

of *H. rotundata* (t. 10. f. 9.), and *H. lenticula* (t. 10. f. 13.) is striated in front, and crenated on the edge; somewhat like those of *Bulimus*.

60. 27. HELIX *pygmæa*. Pygmy Snail. — Shell rather convex, pale chocolate-brown, semitransparent; aperture semilunar; umbilicus large. (t. 5. f. 46.)

Helix elegans. *Sheppard's MSS. Brit. Mus.* — Helix pygmæa. *Drap.* p. 114. t. 8. f. 8—10.; *Gray. Med. Rep.* 1821, 239.; *Turton, Man.* ed. 1. 61. f. 46.; *Nilson, Suec.* 32.; *Jeffreys, Linn. Trans.* xiii. 343.; *Rossm. Icon.* viii. f. 532.; *Forbes and Hanley, B. M.* iv. 83. t. 121. f. 9, 10. — Zonites rupestris. jun. *Leach, Moll. S.* 78.—H. (Delomphalus) pygmea. *Moq. Tandon, Moll. Franc.* ii. 102. t. 10. f. 2—6. — Helix Kirbii. *Sheppard, Linn. Trans.* xvi. 162.; *Jeffreys, Linn. Trans.* xiii. 512. — Helix minuta. *Studer*, in *Coxe's Travels*, iii. 428. — Discus pygmæus. *Fitz. Syst.* 99. — Patula pygmæa. *Held. Isis*, 1837, 916. — Euryomphala pygmæa. *Beck, Ind.* 9. — Zonites pygmæus. *Gray, Man.* 167. t. 5. f. 46.

Inhab. ditches and wet places, among dead leaves. (*Gray*, 1821.)

Shell half the size of the last, of a pale and hardly transparent brown horn-colour, slightly striate, equally convex on both sides, with the apex usually whitish as if decorticated, with four well defined volutions; aperture roundish crescent-shaped, as long as it is wide; jaw slender, striated, and crenulated.

61. 28. HELIX *umbilicata*. Open Snail. — Shell convex, somewhat trochiform, blackish-brown, opaque, striolate; aperture nearly circular; umbilicus very large. (t. 5. f. 45.)

Helix umbilicata. *Mont.* p. 434. t. 13. f. 2.; *Jeffreys, Linn.*

*Trans.* xiii. 843.; *Forbes and Hanley, B. Moll.* iv. 81. t. 121. f. 7, 8. — Helix rupestris. *Drap. Moll. Franc.* p. 82. t. 7. f. 7—9.; *Turton, Man.* ed. 1. 60. f. 45.; *Rossm. Icon.* viii. f. 534. — Zonites rupestris. *Leach, Moll. Syn.* 74. — Turbo myrmecidis. *Scacchi, Oss. Zool.* i. 11. — Zonites umbilicatus. *Gray. Man.* 166. f. 5. t. 45. — Pyramidula rupestris. *Fitz. Syst.* 95. — Patula rupestris. *Held. Isis*, 1837, 916. — Euryomphala rupestris, and E. umbilicata. *Beck, Ind.* 9. — Delomphalus rupestris, and D. saxatilis. *Hartm.* i. 120. t. 37. f. 1—6. — Helix spirula. *Villa Désp. Syst.* 56. — Helix aliena. *Ziegler*, in *Pfeif. Symb.* i. 39.

On elevated rocks, and under the top stones of walls and lofty buildings, always in dry places, on calcareous soils.

Animal black-grey, polished; upper tentacles cylindrical; jaw narrow, regularly striated in front, and minutely crenulated on the edge. (*Moq. Tand.* t. 15. f. 10.)

Shell the tenth of an inch in diameter, elevated on the upper side, with five rounded and deeply divided volutions, slightly striate, of an uniform deep opaque chocolate-brown; aperture nearly circular, being very little interrupted by the penultimate volution, the margin thin and not reflected; umbilicus funnel-shaped.

This shell varies in the elevation and depression of the spire.

Montagu observes it is remarkable that "this shell always affects such lofty places as the tops of houses, without one being found near the base; and in that situation its inhabitant braves equally the scorching beams of the sun in summer and the frigid wind of winter, without attempting to descend." (*Test. Brit.* 435.)

Colonel Montagu's name should be retained for

this species, as his work was published in 1803, and Draparnaud's in 1805. The English conchologists, not paying attention to this fact, have very generally committed an injustice to their countryman, in favour of a foreigner, in a manner of which few foreign naturalists would be guilty. Indeed, few of them have been willing to do sufficient justice to Montagu's great merit; for he was almost the first zoologist in modern times who attempted to pay any attention to the animals inhabiting shells; and we should recollect that, during the whole period he was writing, he was shut out by the war from any communication with our Continental brethren, and was solely dependent on his own energies.

†† *Body of animal and mouth of shell compressed, longer than broad, from back to front than from side to side, that is to say, in the direction of the longitudinal axis of the shell.* (Bulimina.)

5. Succinea *Drap.* (Amber Snail.)

The animal with a large gelatinous foot, short inflated tentacles, and an oblong spiral body, lying on the upper part of the foot; body covered with an oval-oblong thin shell, with a short conical spire, and rapidly enlarging whorls, ending in a large longitudinal oblique mouth, with the peristome disunited behind; pillar smooth, and with an imperforated axis.

This genus is easily known from *Helix* and *Zonites* by the oblong shape; and from *Limnæus*, with which

the older conchologists often confounded it, by there being no appearance of any oblique fold on the pillar.

Montagu justly observes that the animal, like the other *Limaces* possessing four tentacula, is hermaphrodite, and sometimes unites as late as the month of August. (*Test. Brit.* 398. and *Sup.* 139.)

It is named from the transparent amber colour of its shell.

They are found in damp marshy places on the mud, water-flags, &c., but are scarcely to be considered as amphibious, for they are never found in the water, like the *Limnæi* or Pond snails. The jaw is thick, with a central prominence; the teeth are truly helicine in their conformation, the central strong, apex three-pointed, the lateral thick, robust, with two unequal oblique lobes.

The eggs are globular, yellowish-hyaline, adhering in agglutinated masses to plants and stones.

Epiphragm thin, membranaceous, transparent.

62. 1. SUCCINEA *putris*. Common Amber Snail. —Shell oblong-oval, smooth, glossy, and transparent, reddish amber colour; whorls three; aperture oblong-oval. (t. 4. f. 73.)

Turbo tri-anfractus. *Da Costa*, 92. — Succinea amphibia. *Drap. Tabl.* 55.; *Hist. Moll.* 58. t. 3. f. 22, 23.; *Lam. H.* vi. 135.; *Brard*, p. 72. t. 3. f. 1.; *Sowerby, Gen.* f. 3.; *Turt. Man.* ed. 1. p. 91. — Succinea Mülleri. *Leach, Syn. Moll.* 58. — Succinea putris. *Flem. B. A.* 267.; *Jeffreys, Linn. Trans.* xvi. 325. 505.; *Gray, Man.* 178.; *Forbes and Hanley, B. M.* iv. 132. t. 131. f. 1—5.; *Moq. Tandon, Moll. Franc.* ii. 55. t. 7. f. 1. 5. — Helix putris. *Linn. S. N.* 1. 1249.; *Donov. B. S.* t. 168. f. 1.; *Mont.* p. 376. t. 16. f. 14. — Helix

succinea. *Müller, V.* ii. 296.; *Turt. Dict.* p. 67. — Helix limosa. *Pulteney, Dorset.* 48.; *Dillwyn,* p. 965. — Lucerna putris. *Oken, Lehrb. N.* iii. 312. 1815. — Bulimus succineus. *Brug. E. Meth.* i. 308. — Cochlohydra putris. *Fér.* — Lymnea succinea. *Flem. Edinb. Ency.* vii. 77. — Tapada putris. *Studer, Schw. Conch.* ii. — Neritosoma vetula. *Klees, M. ost.* 55. t. 3. f. 70. 1753. — Amphibina putris. *Hartm. N. Alp.* i. 247.

Var. *a*, more slender, t. 4. f. 74, 74*.

Helix angusta. *Studer*, in *Coxe's Travels*, iii. 438. — Succinea putris, var. *a. Jeffreys, Linn. Trans.* xvi. 325. 505. — Succinea amphibia *b. Pfeiffer*, 67. t. 3. f. 37. — Succinea oblonga. *Leach, Moll. MSS.*; *Turton, Man.* ed. 1. t. 4. f. 74.; *Alder, Cat.* 6. n. 20. (not *Drap.*) — Succinea Mülleri *β*. *Leach, Moll. Syn.* 58. — Succinea amphibia. *Nilson, Moll. Suec.* 41. — Succinea amphibia *γ* and *δ*; *Drap. Mollusc.* f. 23. — Succinea Pfeifferi. *Rossm. Icon.* t. 92. f. 46.; *Gray, Man.* t. 4. f. 74. — Succinea putris, var. gracilis. *Macgillivray, Moll. Aberd.* 99.; *Forbes and Hanley, B. M.* iv. 133. — Succinea intermedia. *Bean, MSS.* — Succinea gracilis. *Alder, Mag. Zool. and Bot.* ii. 106.; *Johnst. Berw. N. H. Club*, 1838. — Succinea levantina. *Desh. Lam. Hist.* ed. 2. vi. 317.? — Amphibulina putris, var. *Hartm.* in *Sturm*, t. 6, 7. — Succinea amphibia *β*. *Philippi.*

In marshes, on aquatic plants, in most parts of England.

Animal grey, spotted; tentacles rugose.

Shell, when containing the animal, blue-black; about three quarters of an inch long, and half as much broad, of a greenish, amber, or orange-yellow colour, very thin and transparent; spire composed of three volutions, the first extremely large and inclining a little obliquely; the two upper ones very small, and ending rather obtusely; aperture covering three fourths of the shell; pillar spiral, visible internally to the end or apex.

*Fig.* 41.

Dr. Fleming observes, "A variety of this shell sometimes occurs with a thickened expanded subreflexed white lip." (*Brit. Anim.* 267.) I think this must be a mistake, and should have been a remark appended to *Limnæus peregerr:* it was probably copied from *H. putris* of Maton and Racket, which is the latter species! (See *Linn. Trans.* viii. 229., and *Mont. Test. Brit. Sup.* 139.)

63. 2. Succinea *oblonga.* Oblong Amber Snail. —Shell oval, rather ventricose, slightly striate, reddish horn colour; whorls three or four, produced; suture distinct; aperture oval. (t. 6. f. 139.)

Helix elongata. *Studer*, in *Coxe's Travels*, iii. 432.—Succinea oblonga. *Drap. Tab. M.* 56., *Hist.* p. 59. t. 3. f. 24, 25.; *Jeffreys*, *Linn. Trans.* xvi. 325. 505.; *Alder*, *Mag. Zool. and Bot.* ii. 106.; *Rossm. Icon.* f. 27.; *Forbes and Hanley*, *B. M.* iv. 137. t. 131. f. 6, 7. 32, 33.—Helix (Cochlohydra) elongata. *Férus. Prod.* 10., *Hist.* t. 11. f. 1, 2.—Amphibina oblonga. *Hartm. N. Alp.* i. 248.—Amphibulina oblong. and elongata. *Hartm.* in *Sturm*, *Fauna*, vi. t. 8, 9.—Suceinea arenaria. *Bouchard*, *Moll. Boul.* i. 190.; *Potiez and Michaud*, *Gal.* i. 67. t. 11. f. 3, 4.—Tapada oblonga. *Studer.*

Inhab. edges of ditches, and in sandy places by the seaside.

Animal black-grey; tentacles nearly conical.

Shell small, like *Limnæus fossarius* in shape; the spire conical, produced, as long as the mouth.

This is probably the small variety indicated by Dr. Johnston as about 3-10ths of an inch long; it is common in Berwickshire. "It seems to be," he

adds, " a perfect shell, and in the places where it abounds the larger shell is not found." (*Berwick N. Hist. Club*, p. 154.)

It is common on the dunes near the sea, covering its shell with a viscous secretion, and in winter buries itself in the sand.

### 6. Bulimus. (Twist Shell.)

The animal is moderately large (like the snails), with four tentacles, a small elongate foot, and a long central, slender, spiral body covered with an oblong shell; the spire produced and ending rather acutely, with the ultimate volution larger than the next; aperture oval, entire at the base, without teeth, not half as long as the spire; the peristome interrupted; outer lip generally thickened, reflexed.

The shell of this genus is distinguished from that of *Limnæus* in wanting the oblique fold on the pillar; from the *Clausiliæ* in being regular, and in having the peristome simple and interrupted; and from the *Pupæ* in having the spire regularly tapering.

Probably called *Bulimus* from their eagerness to feed on vegetable substances.

Hartmann, and more recently Mr. Broderip, have changed the name of this genus to *Bulinus*, thinking probably that it was derived from the *Bulin* of Adanson; but that is an *Aplexus*.

They may be divided into two sections.

a. *Shell ovate, whorls gradually enlarging, covered with a brown periostracum; peristome thickened, reflexed.* (Ena *Leach.*)

64. 1. BULIMUS *montanus.* Wiltshire Twist Shell. —Shell conic-oblong, reddish brown, obliquely striolate; the peristome reflected and forming an umbilicus. (t. 6. f. 62.)

Helix lackamensis. *Mont.* p. 394. t. 11. f. 3. — Helix buccinata. *V. Alten, E. and F. Conch.* 100. t. 12. f. 22. — Bulimus Montacuti. *Jeffreys, Linn. Trans.* xvi. 345. — Bulimus obscurus. *Hartmann, N. Alpina*, i. 222.—Bulimus montanus. *Drap. Tab. Moll.* 65., *Moll.* p. 74. t. 4. f. 22.; *Turton, Man.* ed. 1. 80. f. 62.; *Sturm, Fauna*, vi. t. 6.; *Pfeiffer*, 52. t. 2. f. 10.; *Rossm. Icon.* i. f. 41. vi. f. 386. — Bulimus (Bulimulus) montanus. *Charpent.* 14. t. 2. f. 2. — Helix sylvestris. *Studer*, in *Coxe's Travels.* — Helix obscura. *Schrank, Fauna, B.* iii. 273. — Bulimus lackamensis. *Fleming, B. A.* 265.; *Gray, Man.* 181.; *Forbes and Hanley, B. M.* iv. 89. t. 128. f. 6. — Bulimulus lackamensis. *Beck, Ind.* 71. — Ena montana. *Leach, Moll. Syn.* 80.; *Hartmann.*

In moist beech woods, among decayed leaves, and on the bark of trees. Wiltshire, Bristol, southern and western.

Animal pale; tentacles club-shaped. (*Mont., Sturm.*)

Shell five eighths of an inch long, and a quarter of an inch wide, deep chocolate-brown varying to light grey, conically elongated; spire consisting of seven slightly raised but well-defined volutions ending in a rather acute point, irregularly and obliquely striate longitudinally, and when magnified having the appearance of a shagreen-like roughness; aperture oblong-oval, with the peristome chocolate-brown

and reflected, forming an umbilicus behind the pillar.

The shell varies considerably in size and ventricoseness; also in colour, being sometimes whitish horn colour, and semitransparent, arising, as in other varieties of the kind, from a disordered state of the animal preventing the secretion of the colouring and chalky matter.

It appears to grow slowly; for Montagu observes that scarcely one in ten of the shells he found had their mouths perfected; when young the shell, as in the next, is short, conic, and trochus-like, with a sub-quadrangular mouth. (*T. B.* 395.)

65. 2. BULIMUS *obscurus*. Dusky Twist Shell.—Shell oval-oblong, brown, with the peristome white and reflected, forming a small umbilicus. (t. 6. f. 63.)

Helix obscura. *Müller, Verm.* 103.; *Gmelin, S. N.* 2661.; *Montagu, F. B.* p. 391. t. 22. f. 5.—Turbo rupium. *Da Costa,* p. 90., from *List. Ang.* t. 2. f. 8.—Bulimus hordeaceus. *Brug. E. M.* 334.; *Lam. Hist.* viii. 236.—Bulimus obscurus. *Drap. Moll. Franc.* p. 74. t. 4. f. 23.; *Brard,* p. 97. t. 3. f. 19.; *Turton, Man.* ed. 1. 81. f. 63.; *Jeffreys, L. T.* xvi. 343.; *Rossm. Icon.* vi. f. 387.; *Forbes and Hanley, B. M.* iv. 90. t. 128. f. 7.—Lymnea obscura. *Flem. Edinb. Ency.* vii. 78.—Bulimus obscurus β. *Hartm. N. Alp.* i. 222.—Merdigera obscura. *Held. Isis,* 1837, 917.—Bulimulus obscurus. *Beck, Ind.* 71.—Helix stagnorum. *Pulteney, Dorset.* 49 (?).—Ena obscura. *Leach, Moll. Syn.* 81.

In woods and old walls, under stones or moss.

Animal rosy grey; foot thick, paler; upper tentacles subulate.

Shell half an inch long, and about a third as much broad, brown or horn-colour, semitransparent; spire

composed of six or seven raised volutions, slightly striate longitudinally; aperture oblong-oval, with the margin white and reflected, forming a slight umbilicus behind the pillar. The young shell conical, pyramidal, with a subquadrangular mouth.

It scarcely differs, except in size, from the last species; but it is of a paler brown, with the volutions more rounded, and the peristome is white.

Varies like the last, and being more common, the varieties are more often observed.

The jaw of *B. montanus* and *B. obscurus* is lunate, rather narrow, crenated on the edge.

The Rev. Mr. Sheppard remarks, "These shells, particularly in their young state, show great sagacity and ingenuity, by covering themselves with a coat adapted to the different situations in which they are found; and when so covered, it is almost impossible for any other than a conchological eye to discover them. If its abode be upon the trunk of a tree covered with *lichen*, then is the epidermis so constructed as to cause the shell to resemble a little knot on the bark covered with such substance. If on a smooth tree, from whose bark issue small sessile buds, as is frequently the case, it will pass off very well for one of them; and on a dry bank, or the lower part of the body of a tree splashed with mud, its appearance will be that of a misshapen pointed piece of dirt." (*Linn. Trans.* xvi. 166.)

b. *Shell turreted, white, banded, covered with a thin periostracum; whorls rapidly and regularly enlarging; mouth small; peristome thin, scarcely*

*reflexed. Jaw like Helix, costate and toothed* (Elismia.)

66. 3. BULIMUS *acutus.* Banded Twist Shell. — Shell oblong, rather acute, coarsely wrinkled or striate, generally whitish, with brown streaks or bands. (t. 6. f. 67.)

Helix barbara. *Linn. S. N.* ed. 12. 1241. (?) — Turbo (Turricula) maroccana. *Chemn. C. C.* xi. 280. f. 2063, 2064. — Elismia fasciata. *Leach, Moll. Syn.* 79. — Bulimus acutus. *Brug. E. M.* f. 323.; *Drap.* p. 77. t. 4. f. 29, 30.; *Jeffreys, Linn. Trans.* xvi. 346.; *Rossm. Icon.* vi. f. 378.; *Forbes and Hanley, B. M.* iv. 86. t. 128. f. 5. t. G G G. f. 6. — Turbo fasciatus. *Pennant, B. Z.* i. 31. t. 8. f. 119.; *Mont.* p. 346. t. 22. f. 1. — Helix bifasciata. *Pulteney*, 49.; *Linn. Trans.* viii. 210.; *Turton, Dict.* p. 63. — Helix acuta. *Müller, Verm.* 110.; *Dillwyn*, p. 956. — Lymnæa fasciata. *Flem. Ed. Ency.* vii. 78. — Bulimus fasciatus. *Turton, Man.* ed. 1. t. 84. f. 67.—Bulimus ventricosus. *Turton, Man.* ed. 1. t. 84. f. 69., not *Drap.* — Helix (Cochlicella) acuta. *Férussac, Prod.* n. 378.—Helix cretacea. *Chemn. C.* ix. 190. f. 1268. — Bulimus articulatus. *Lamk. H.* vii. 234.; *Deless. Rec. Coq.* t. 28. f. 8. (not *Turton, Man.* ed. 1.). — Bulimus Turritella. *Andrz. Bul. Soc. Moscou*, vi. 415. — Cochlicella meridionalis, and C. Turricula. *Risso, Eur. Merid.* iv. 78. t. 3. f. 26. — Cochlicellus acutus. *Beck, Ind.* 63.—Bulimus litoralis. *Brumati, Cat.* 34. f. 9.—Bulimus variabilis. *Hartmann; Sturm, Fauna*, vi. t. 12.

On sandy maritime pastures, or calcareous soils, in the west of England and Wales, Ireland and Scotland, especially near the sea.

Animal pale yellowish; upper tentacles long, subulate, lower very short; jaw with four ribs and strong teeth.

Shell half an inch or rather more in length, and about a third as much broad, oblong, semitransparent, variously marked, but always coarsely wrinkled longitudinally, and sometimes of a greyish colour with

white longitudinal streaks; spire consisting of from nine to twelve somewhat rounded volutions, ending rather acutely; aperture oval, longer than wide; the peristome reflected and forming a slight perforation at the pillar.

This shell varies very greatly in its colour, being sometimes nearly white without bands, and at others variously banded; the hinder bands are often wanting or interrupted, and sometimes instead of being banded, the shell is marked with oblique longitudinal streaks, sometimes the black and sometimes the white being the more abundant, and consequently forming the ground colour. It varies slightly in shape, and is sometimes much elongated.

M. Moquin Tandon describes the anatomy of this animal as similar to that of *Helix*, and regards it as a *Helix* with an elongated turreted spire.

In the places where it is found it is often so abundant that it is a prevailing opinion that they contribute much to the fattening of sheep. (See *Borlase*, *Hist. Corn.* 286.; *Mont. Test. Brit.* 347.) It is often found in company with *Helix virgata* (see *Test. Brit.* 417.), which is supposed to have the same qualities.

### 7. Zua *Leach.* (Varnished Shell.)

Animal like *Bulimus*, with an ovate subcylindrical rather blunt shell, covered with a smooth polished periostracum; mouth ovate, thickened, and united all round; peristome toothless; axis imperforated.

This genus is easily known from *Bulimus* by the lished periostracum, and continued, thickened, not

reflexed lip; and from *Azeca* by the simple peristome.

The jaw is lunate, narrow, minutely crenulated.

Mr. Jeffreys has established a genus under the name of *Cionella* for the following species and *Achatina Acicula;* but these shells appear to have no natural alliance to one another, and the characters given to the genus are hardly such as could distinguish a species.

67. 1. ZUA *lubrica*. Common Varnished Shell. — Shell cylindrical-oblong, quite smooth, glossy, and semitransparent; the peristome thick, without umbilicus. (t. 6. f. 65.)

Helix lubrica. *Müller, Verm.* 104.; *Mont.* p. 390. t. 22. f. 6.; *Linn. S. N.* 1248. — Turbo glaber. *Da Costa*, p. 87. t. 5. f. 18.—Bulimus lubricus. *Brug. E. M.* i. 311.; *Drap. Hist.* p. 75. t. 4. f. 24.; *Brard*, p. 98. t. 3. f. 20.; *Pfeiffer*, 50. t. 3. f. 7.; *Turton, Man.* ed. 1. 82. f. 65.; *Hartm. N. Alpina*, i. 222. — Lymnæa lubrica. *Flem. Ed. Ency.* vii. 78. — Cionella lubrica. *Jeffreys, Linn. Trans.* xvi. 347. 513. — Zua lubrica. *Gray, Man.* 188.; *Leach, Moll. Syn.* 82.; *Forbes and Hanley, B. M.* iv. 125. t. 125. f. 8. t. G G G. f. 5. — Helix subcylindrica. *Linn. S. N.* 1248; *Chemn. C. C.* ix. f. 1255; *Dillwyn*, p. 952. —Achatina lubrica. *Menke, Syn.* 29.; *Rossm. Icon.* i. f. 43.; *Alder, Mag. Zool. and Bot.* ii. 110.; H. (Cochlicopa) lubrica. *Férus. Prod.* 374. — Cochlicopa lubrica. *Risso, E. M.* iv. — Helix splendidula. *Gmel. S. N.* 3655. — Turbo muscorum. *Penn. B. Z.* iv. t. 82. f. 118. (?) — Columna lubrica. *Jans, Cat.* 5. — Styloides Lumbricus. *Fitz. Syst.* 105. — Buccinus obtusulum. *Mont. T. B.* 250., from *Walker, T. M. R.* f. 59., junior. — Bulimus subcylindricus. *Poiret, Prod.* 45.; *Moquin Tand. Moll. Franc.* ii. 304. t. 22. f. 15—19. — Achatina lubricella. *Ziegler.* — Zua Boissii. *Dupuy, H. Moll. Franc.* iv. 332. t. 15. f. 9.

Under stones and among moss and grass on the ground.

Animal shining black, brown, or blackish grey above, paler beneath; tentacles black, lower very small. (*Sturm.*)

Shell hardly a quarter of an inch long, and a third of its length broad, of a glossy brown or horn-colour, with often a reddish tinge, quite smooth and polished; spire composed of five or six raised volutions; aperture narrow-oval, with the margin thick and not reflected, often of a rosy colour.

Varies in shape, size, and colour, sometimes transparent greenish white.

This species was first figured as English by Lister (*Anim. Ang.* t. 2. f. 7.) and Petiver (*Gaz.* t. 30. f. 7.)

### 8. Azeca *Leach.* (Trident Shell.)

Animal like *Bulimus*, with subcylindrical, rather obtuse shell, covered with a polished periostracum; aperture pear-shaped, curved and pointed at the top; the margin thick, obtuse, and united all round and toothed; the axis imperforated.

In shape, colour, polish, and habitat, this shell so exactly resembles the *Bulimus lubricus*, that some have questioned if this latter shell be not the same in its earlier stage of formation before the teeth appear; but the singular shape of the aperture decidedly removes it into a distinct genus, which is adopted from Dr. Leach. The jaw is lunate, narrow, crenulated on the edge.

Mr. Alder considers this genus as intermediate between *Bulimus* and *Clausilia*, resembling the former in shape, and approaching more to the latter in having the peristome complete, and also more particularly in having a longitudinal plate on the columella, considerably within the aperture, similar in situation and making a slight approach in form to the *clausium*

of the genus *Clausilia*, though attached through its whole length, and inflexible.

68. 1. AZECA *tridens*. Glossy Trident Shell. (t. 5. f. 52.)

Turbo tridens. *Pult. Cat.* 46.; *Montagu, T. B.* p. 338. t. 11. f. 2., *Supp.* 125.; *Laskey, Wern. Soc.* i. p. 406. t. 8. f. 11. — Pupa Goodalli. *Férussac, Prod.* 71. — Pupa britannica. *Kenyon, Mag. N. H.* i. 426. f. 182. n. — Azeca Matoni. *Leach, Moll. Syn.* 88. t. 8. f. 8.; *Turton, Man.* ed. 1. 68. f. 32. — Helix (Cochlodonta) Goodalli. *Féruss. Prod.* 492. — Azeca tridens. *Flem. B. A.* 269.; *Alder, Cat.* 32.; *Gray, Man.* 189.; *Forbes and Hanley, B. M.* iv. 128. t. 125. f. 9. — Zua tridens. *M. E. Gray, Fig. Moll.* — Azeca Nouletiana. *Dupuy. Moll. Franc.* 358. t. 15. f. 12. — Azeca Goodallii. *Alder, Mag. Zool. and Bot.* ii. 110. — Carychium Menkeanum. *Pfeiffer, D. M.* 70. t. 3. f. 42. 1821. — Pupa Menkeana. *C. Pfeiffer, D. M.* iii. 62. t. 7. f. 7, 8. — Carychium politum. *Jeffreys, Linn. Trans.* xvi. 365. — Cionella Goodallii. *Jeffreys, Linn. Trans.* xvi. 517. — Pupa Goodallii. *Michaud, Comp.* 68. t. 15. f. 39, 40. — Achatina Goodallii. *Rossm. Icon.* x. f. 654. — Achatina tridens. *L. Pfeiff. Helic.* ii. 277. — Bulimus Menkeanus. *Moquin Tand. Moll. Franc.* ii. 302. t. 22. f. 7—11.

In woods, damp closes, under moss, among decayed leaves, and in thick shady places.

Animal brownish black, shining; upper tentacles cylindrical, club-shaped.

Shell two tenths of an inch long, and a third part as broad, oblong or conico-cylindrical, brown horn colour, semitransparent, quite smooth and glossy, except close to the sutures, where there appear some fine longitudinal striæ; spire composed of seven flat and hardly raised volutions; aperture pear-shaped, curved, and narrower at the upper and outer angle; the peristome thickened and obtuse.

*Fig.* 42.

This shell varies in shape, size, and colour, being sometimes transparent greenish white, from want of substance and colouring matter. It also varies in having one or two additional small teeth in the peristome alternately with the larger ones.

### 9. Achatina *Lam.* (Agate Shell.)

Animal like *Bulimus*, with four tentacles and an oval-oblong or somewhat cylindrical shell, obtuse at the tip; aperture longitudinal, oval; the outer lip thin, without any internal rib, and never reflected; pillar smooth, simple, truncate in front.

The abruptly truncated termination of the pillar or inner lip of the shell will immediately distinguish this genus from *Bulimus*, to which it is in other characters so nearly allied. The only British species forms a very distinct section, perhaps genus, from the larger exotic kinds.

a. *Shell turreted, polished, transparent; mouth oblong, rather narrow; upper tentacles subulate, blunt, eyeless.* (Styloides. Acicula *Nilson.*)

69. 1. Achatina *Acicula.* Needle Agate Shell.—Shell slender, smooth, polished, white, with six flat volutions; the lower one as long as all the others; mouth elliptical. (t. 6. f. 77.)

Achatina Acicula. *Lam.* vi. p. 133.; *Rossm. Icon.* x. f. 658.; *Forbes and Hanley, B. M.* iv. 130. t. 128. f. 4. — Bulimus Acicula. *Brug. E. M.* 1. 311.; *Drap.* p. 75. t. 4. f. 25, 26.; *Brard*, p. 100. t. 3. f. 21. — Buccinum terrestre. *Mont. T. B.* p. 248. t. 8. f. 3. — Buccinum Acicula. *Müller, Verm.* ii.

150.; *Dillwyn*, p. 652. — Helix octona. *Gmel. S. N.* i. 3653. — Cionella Acicula. *Jeffreys*, *Linn. Trans.* xvi. 348. — Bulimus (Polyphemus) Acicula. *Charpent.* — Helix Acicula. *Studer*, in *Coxe's Travels.* — Helix (Cochlicopa) Acicula. *Fér. Prod.* 371. — Bulimus Acicula. *Hartm. N. Alpina*, i. 222. — Acicula eburnea. *Risso*, *E. M.* iv. 81. — Columna Acicula. *Jans*, *Cat.* 4. — Styloides Acicula. *Fitz. Syst.* 105. — Acicula Acicula. *Beck*, *Ind.* 79. — Polyphemus Acicula. *Villa*, *Syst.* 20. — Cecilioides Acicula. *Beck*, 122. (1848). — Cæcilianella terrestris, C. anglica, C. Lievillii. *Bourg. Rev. and Mag. Zool. Aug.* 1856, 378. — Buccinum longiusculum. *Walker*, *T. M. R.* f. 60. — Jaminia longiuscula. *Brown*, *Ill. Conch.*

Among roots of grass and under moss. Subterraneous.

Animal pellucid white, granulately striated; tentacula retractile, cylindrical, upper pair longest, granular, not thickened at the top, smooth, convexly truncated, without any black spot (eyes); lower pair opposite the angles of the mouth; foot compressed, pointed behind; breathing-hole large, rounded, in the middle of the outer lip of the shell.

Shell not a quarter of an inch long, taper; aperture oval-oblong, appearing as if cut off at the base, giving the end of the pillar the resemblance of a tooth; the outer margin thin, not reflected, nor forming an umbilicus.

This common species was first noticed as British by Mr. Boys (fig. 61.); and his figure 89. appears to represent the young shell. It is very common, six or eight inches deep in the ground, in Yorkshire, on the tops of gravel pits, and in Saxon coffins.

The animal, from the transparency of the shell, may be seen to dilate and contract its respiratory cavity through the shell. This motion has been

taken for the beating of the heart; it is irregular, sometimes fast and sometimes slow. The animal is black, nocturnal, and subterraneous; the mouth is vertical linear; the jaw small, horny, smooth or very minutely striated.

The eggs are large compared to the size of the shell; and this explains the bluntness of the apex, arising from the large size of the body of the animal, on which the shell is formed before it is hatched.

Férussac (1807) first observed that this animal was deprived of ocular points. (*Essai*, iii.) Nilson, in 1822, repeated the account, and added that the apex of the tentacle was furnished with a small smooth annular depression (*Moll. Suec.* 29.). M. Bourgegnart, on this character, has formed it into a genus.

### 10. Pupa *Lam.* (Chrysalis Shell.)

Animal like *Bulimus*, with four club-shaped tentacles, the lower pair short, small, and with a cylindrical abruptly obtuse shell, with close pressed, gradually enlarging whorls; the mouth semi-oval, mostly toothed internally; peristome reflexed, and interrupted behind. Jaw lunate, narrow, very slightly striated and crenulated.

The young shells have a flattened front to the whorls, and a squarish mouth, so that they were mistaken by some of the older conchologists for *Trochi;* the older whorls are more convex and rounded in front, and the animal does not form the reflexed lip until it has arrived at maturity; consequently, like the *Clausiliæ* among land shells, and the *Strombi*

and *Cypræa* among marine ones, it only forms the complete mouth to its shell once in its life. (See *Phil. Trans.* 1833.)

These shells are called Pupa, Puppet, or Doll, because they resemble children in their swaddling-clothes.

a. *Peristome margined, reflexed; the young shell with a transverse series of short triangular plates.* (Lauria *Gray.*)

Mr. Alder has observed that *Pupa umbilicata* and *P. anglica* have a very curious and elaborate internal structure. They have a raised thread-like lamina, running spirally round the columella in the manner of a corkscrew, and another similar lamina running spirally in the centre of the upper side of the whorls; and there are set at short distances small flat testaceous plates similar in situation to the septa in *Nautilus lacustris.* This complicated structure is, no doubt, intended to answer some useful purpose in the economy of the animal; but what is its use besides the protection of the animal in a young state, he has not been able to discover. It is not continued through the lower whorls, and is most distinctly seen in the young shells. This structure is not found in the young of *Pupa marginata, P. edentula,* and *P. sexdentata.*

70. 1. PUPA *cylindracea.* Umbilicated Chrysalis Shell. — Shell cylindrical, bald, smooth, brownish; whorls five to seven; mouth elongate lunate, with a single laminar tooth united to

the upper angle of the outer lip; peristome with a white flat reflected margin; umbilicus narrow. (t. 7. f. 78.)

Turbo muscorum. *Pulteney, Dorset*, 46.; *Mont.* p. 335. t. 22. f. 3.; *Linn. Trans.* viii. 182. — Turbo cylindraceus. *Da Costa, B. C.* p. 89. t. 5. f. 16. 1777. — Pupa umbilicata. *Drap. Tab. Moll.* 58. (1801); *Hist. Moll.* p. 62. t. 3. f. 39, 40.; *Jeffreys, Linn. Trans.* xvi. 357.; *Rossm. Icon.* t. 23. f. 327.; *Forbes and Hanley, B. M.* iv. 95. t. 129. f. 7. — Pupa cylindracea. *Moq. Tand. Linn. Soc. Bord.* xv. 1849; *Moll.* ii. 390. t. 27. f. 42, 43. — Helix (Cochlodonta) umbilicata. *Férus. Prod.* n. 474. — Pupilla Draparnaudii. *Leach, Moll. Syn.* 91. — Pupa muscorum. *Flem. B. A.* 268. — Pupilla umbilicata. *Beck, Ind.* 84. — Eruca umbilicata. *Swains. Malac.* 334. — Stomodonta umbilicata. *Mermett, Moll. Pyr.* 53. — ? Pupa bidentata. *Brown, Ill. Conch.* 39. t. 14. f. 6. — Bulimus muscorum. *Brug. E. M.* i. 334., partly. — Odostomia muscorum. *Flem. Ed. Ency.* vii. 76. — Jaminia muscorum. *Risso, E. M.* iv. p. 88.

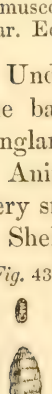
Var. Edentula, mouth without teeth.

Under stones, in clefts of old walls, and under the bark of trees, in shady places. Common in England and Scotland.

Animal granular; head and tentacles black, lower very small; foot whitish. (*Michaud.*)

Shell two lines long, dark horn-colour, glossy and semi-transparent; spire composed of six rounded volutions finely striate longitudinally; aperture roundish-oval, with a broad, flat, glossy white margin, and a single tooth which is parallel with the margin and close to the outer lip, appearing like a curved continuation of the margin itself; pillar with a large deep perforation behind it. (fig. 43.)

*Fig.* 43.



This does not appear to be the *Turbo muscorum* of Linnæus, who describes it as having no tooth in

the aperture, "apertura edentula," and nowhere mentions the remarkable broad white margin.

Mr. Alder, on breaking some of these shells, found them to contain (ten or twelve) young shells with the first whorl of the shell formed. This would lead to the conclusion that the animal is viviparous. The same has been observed to be the case with several other terrestrial shells, as *Bulimus decollatus*, *Achatina octona*, and some *Carocollæ*, as *C. bicolor*.

71. 2. PUPA *anglica*. English Chrysalis Shell. — Shell ventricose, shining, bald, fulvous; whorls five; aperture elongate-lunate, five-toothed; the peristome flattened and reflected; umbilicus cylindrical. (t. 7. f. 82.)

Vertigo anglica. *Férussac*, *Prod. Moll.* 64. (no character); *Turton*, *Man.* ed. 1. f. 82. — Pupa tridentalis. *Michaud*, *Compl.* 61. t. 15. f. 28. 30.? — Pupa anglica. *Alder*, *Trans. N. H. Soc. Newcastle*, i. 33.; *Potiez and Michaud*, *Gall.* i. 195. t. 20. f. 1, 2.; *Forbes and Hanley*, *B. Moll.* iv. 99. t. 129. f. 6.; *Moq. Tand. Moll. F.* ii. 404. t. 28. f. 34. 38. — Turbo anglicus. *Gray*, in *Wood. Cat. Supp.* t. 6. f. n. — Pupa ringens. *Jeffreys*, *Linn. Trans.* xvi. 356. 514. (not *Mich.*).

Inhab. woods, north of England, Northumberland, Lancashire. (*Férussac.*)

Animal dark lead-coloured, white beneath.

Shell two lines long, and half as much broad, dark chocolate-brown with often a greyish cast, especially towards the point, opaque, faintly striate longitudinally; spire composed of six or seven slightly raised volutions; aperture semielliptic, with a tubercular projection near the top of the outer lip, and five teeth,—two at the base (one of them small and

tubercular), one central at the top, one at the top of the outer angle, parallel with and united to the peristome, curving so as nearly to meet the marginal tubercle, and form a similar enclosure, and an oblique one on the pillar; peristome flat, brown, reflected, with a strong umbilicus behind the pillar.

b. *Peristome with a strong external rib, and a single tooth in the hinder part of the mouth; young shell with a simple cavity.* (Pupilla *Leach.*)

72. 3. Pupa *muscorum.* Margined Chrysalis Shell. — Shell cylindrical, bald, shining brown; whorls five to seven, convex; mouth roundish lunate, with a single minute interior central tooth, and a strong white external rib behind the outer lip. (t. 7. f. 79.)

Turbo muscorum. *Linn. S. N.* 1240.; *Chemn. C. C.* ix. f. 1076. — Pupa marginata. *Drap.* p. 61. t. 3. f. 36. 38.; *Pfeiffer*, 59. t. 3. f. 23, 24.; *Brard*, p. 93. t. 3. f. 15, 16.; *Jeffreys, Linn. Trans.* xvi. 358.; *Turton, Man.* ed. 1. 98. f. 79. — Pupilla marginata. *Leach, Moll. Syn.* 92. — Turbo chrysalis. *Turt. Dict.* p. 220. — Pupa muscorum. *Lam. Hist. A. S. V.* viii. 180.; *Rossm. Icon.* i. f. 37., v. f. 323. — Helix muscorum. *Müller, Verm.* 105.; *Férus.* — Alæa marginata. *Jeffreys, Linn. Trans.* xvi. 357. — Jaminia marginata. *Risso*, iv. 89. — Pupa muscorum. *Pfeiffer*, iii. 61.?; *Rossm.* i. 83. t. 2. f. 37. r. f. 323. — Turbo marginata. *Sheppard, Linn. Trans.* xiv. 154. (not *Brown*). — Pupa badia. *Adams, Boston, Jour. N. H.* iii. 331. t. 3. f. 18. — Helix (Cochlodonta) muscorum. *Férussac, Prod.* n. 475. — Bulimus muscorum. *Brug. E. M.* i. 334. — Pupilla muscorum. *Beck, Ind.* 84. — Stomodonta marginata. *Mermett, Moll. Pyr.* 53. — Pupa unidentata. *C. Pfeiffer, D. Moll.* i. t. 3. f. 19, 20. — Pupa bidentata. *C. Pfeiffer, D. Moll.* i. t. 3. f. 21, 22. — Jaminia muscorum. *Risso, E. M.* iv. 89.

Var. 1., mouth with the tooth obliterated.

Under stones in dry pastures, and moist open places, on calcareous soils.

Animal grey-black.

Shell the tenth of an inch long, brown or yellowish horn-colour; spire composed of six or seven rounded and slightly striate volutions; aperture semi-circular, with generally a small tubercular tooth placed in the middle and deep within the mouth, but which is sometimes very obscure and often totally wanting; peristome thin, not margined, but slightly reflected and forming an umbilicus; and behind the outer lip is a thick white rounded rib.

*Fig.* 44.

This species varies very much in size, and in the compactness of the spire. (fig. 44.)

Captain Brown has added to the list *Pupa unidentata* Pfeiffer (*Brown, B. S.* t. 41. f. 4.) and *P. bidentata* Pfeiffer (*Brown, B. S.* t. 41. f. 6.). According to Rossmäsler (i. 83.), these species of Pfeiffer are only varieties of *P. marginata.* Brown's figures are so bad that it is not possible to determine what species they are intended to represent.

c. *Peristome slightly reflexed; throat many-plaited; cavity of the young shell simple.* (Abida *Leach.*)

73. 4. PUPA *secale.* Juniper Chrysalis Shell. — Shell cylindrical attenuated at the tip, brown, striated; aperture with seven or eight laminar teeth; the peristome acute and slightly reflected. (t. 7. f. 81.)

Pupa secale. *Drap. Tab. Moll.* 59.; *Hist. Moll.* p. 64. t. 3. f. 49, 50.; *Pfeiffer*, 55. t. 3. f. 14.; *Jeffreys, L. T.* xvi. 353.; *Rossm. Icon.* p. 82. t. 2. f. 35.; *Forbes and Hanley, B. M.* iv. 101. t. 129. f. 5.—Turbo juniperi. *Montagu, T. B.* p. 340. t. 12. f. 12.—Abida secale. *Leach, Moll. Syn.* 90.—Ver-

tigo secale. *Turton, Man.* ed. 1. 101. t. 7. f. 81. — Chondrus secale. *Cuvier, R. A.* iii. 89.; *Hartmann*, 218. n. 20.; *Sturm*, vi. 7. t. 4. — Torquilla secale. *Studer, Cat.* 19. — Helix (Cochlodonta) secale. *Fér. Prod.* 64. n. 488. — Odostomia juniperi. *Flem. E. Ency.* vii. 76. — Turbo cylindrus. *Hartm. N. Alpina*, ii. 212. — Helix cylindrica. *Studer*, in *Coxe's Travels.* — Jaminia secale. *Risso, E. M.* iv. 89. — Pupa juniperi. *Fleming, B. A.* 268.; *Gray, Man.* 197. — Granaria secale. *Held. Isis*, 1837, 918. — Stomodonta secale. *Mermett, Moll. Pyr.* 51.

Inhab. roots of trees and under stones, in chalky districts, and cracks in rocks in oolite limestone.

Animal blackish-brown, warty; foot slender.

Shell a quarter of an inch or rather more in length, of a greyish-brown colour, opaque, obliquely striate longitudinally; spire composed of eight or nine rounded volutions; aperture with seven or eight laminar teeth, two on the pillar lip, three on the outer lip, including the central one, all of which are visible on the back in the appearance of three pale bands; and two on the interrupted part of the peristome, the outer one of which is more prominent and close to the margin, with often a tubercle on its outside.

The shell of the young animal is clothed with an earthy covering, like *Bulimus obscurus*. In this state it is described by Müller, according to Jeffreys, under the name of *Helix ventricosa*.

Montagu (*T. B.* 340.) truly observes that "these projections, usually called teeth, are not properly denticles or tooth-shaped protuberances, but are fine white *laminæ* or ridges running spirally backwards in a parallel direction to each other; those on the exterior lip may in most instances be traced through the outside of the shell;" they are in fact foldings

of the substance of the shell, caused by some withdrawing of the mantle of the animal in the part immediately in connection with them; this is also the case with many of the foreign "toothed" Helices (*Helicodontæ*). The true teeth must be formed nearly in the same way; but they are produced by repeated deposits of layers of calcareous matter, one over the other, to fill up the cavity as the mantle is withdrawn, while these plaits are produced by a sudden contraction of the part which forms a mould for the newly deposited portion of the shell.

### 11. VERTIGO *Müller.* (Whorl Shell.)

The animal, like *Bulimus*, with only two elongate clavate tentacles, the lower pair being wanting or rudimentary, and with a subcylindrical, abruptly obtuse shell, with close-pressed, gradually enlarging whorls; the mouth contracted, more or less angular, generally toothed internally, and thickened by an exterior rib; peristome simple.

This genus has a shell very like the *Pupæ*, but was separated from them by Müller; and his division has been adopted by most succeeding zoologists, because the animal has the upper pair only, of tentacles which bear the eyes, developed.

a. *Shell dextral, cylindrical; mouth margined externally.* (Isthmia *Gray.* Alæa *Jeffreys.*)

74. 1. VERTIGO *edentula.* Toothless Whorl Shell. —Shell conic-oval, ventricose, brown, with five

or six volutions; aperture semicircular, without any tooth; the peristome simple, without margin or rib; umbilicus minute. (t. 7. f. 80.)

Pupa edentula. *Drap. Hist. Moll.* p. 59. t. 3. f. 28, 29.; *Pfeiffer; Alder, Mag. Zool. and Bot.* ii. 112.; *Turton, Man.* ed. 1. 99. t. 7. f. 80. — Turbo offtonensis. *Sheppard, Linn. Trans.* xiv. 155.—Vertigo nitida. *Férus. Prod. Moll.* 64. — Alæa nitida. *Jeffreys, Linn. Trans.* xvi. 358. 515. — Turbo muscorum, var. *Montagu, T. B.* 356. — Jaminia edentula. *Risso, E. M.* iv. 89. — Alæa revoluta. *Jeffreys, Linn. Trans.* xvi. 515. 558.— Turbo edentulus. *Wood, Cat. Suppl.* t. 6. f. 14., young. — Pupa (Sphyradium) edentula. *Charpent.* 15. — Helix exigua. *Studer*, in *Coxe's Travels*, iii. 430. — Vertigo edentula. *Studer, Schr. Conch.* 89.; *Gray, Man.* 199.; *Rossm. Icon.* x. f. 646.—Vertigo lepidula. *Held. Isis*, 1837, 307. — Alæa edentula. *Beck, Ind.* 85. — Stomodonta edentula. *Mermett, M. Pyr.* 54.

Var., shell more elongated and cylindrical.

Marshy places, at the roots of grass, under stones and on trees.

Animal grey; upper tentacles clavate.

Shell the tenth of an inch long, horn-colour, transparent, slightly striate; spire composed of five or six rounded and deeply divided volutions; aperture with a very thin margin, without the rib behind the outer lip.

The young shells are very transparent light horn-colour, and brittle; the apex of the adult shell is often whitish and slightly eroded.

Montagu was acquainted with this shell, but had not fixed it as a distinct species.

It is very probable that this is the true *Turbo muscorum* of Linnæus, as it most accurately answers his definition in the *Systema Naturæ*. "Testa ovata obtusa pellucida, anfractibus senis secundis, apertura edentula."

Mr. Jeffreys, in his Supplement, observes, "The *Alæa revoluta* of his Synopsis is an old bleached specimen, with the aperture placed more extrinsically than usual." (*Linn. Trans.* xvi. 515.)

75. 2. VERTIGO *muscorum*. Cylindrical Whorl Shell. — Shell attenuated, pellucid, pale brown, acutely obliquely striated; whorls five, convex; mouth ovate, slightly margined externally, toothless; umbilicus narrow. (t. 12. f. 140.)

Pupa obtusa. *Flem. Brit. Anim.* 269. (not *Drap.*) — Alæa cylindrica. *Jeffreys, Linn. Trans.* xvi. 359. 515. — Vertigo cylindrica. *Férussac, Tab. Moll.* 64.; *Alder, Mag. Zool. and Bot.* ii. 112.; *Gray, Man.* 200. t. 12. f. 140. — Pupa muscorum, var. *a*. *Drap. Tabl. Moll.* 56. 1801, *Hist. Moll.* 59. t. 3. f. 36, 37. — Pupa minutissima. *Hartmann, Neue Alpina*, 220. t. 2. f. 5. 1821; *Pfeiffer*, iii. 38. t. 7. f. 12, 13.; *Rossm. Icon.* i. t. 2. f. 38. 84.; *Forbes and Hanley, B. M.* iv. 104. t. 130. f. 2. — Pupa minuta. *Studer, Cat.* 89. 1820. — Vertigo muscorum. *Mich. Comp.* 70.; *Moq. Tand. Moll. Franc.* ii. 399. t. 28. f. 20. 24. — Pupa (Sphyradium) muscorum. *Charpent.* i. 15. — Vertigo pupula. *Held. Isis*, 1837, 303. — Alæa minutissima. *Beck, Ind.* 85. — Eruca muscorum. *Swain. Malac.* 334. — Vertigo minutissima. *Gruells, Cat.* 7. — Stomodonta muscorum. *Mermett, Moll. Pyr.* 55.

Inhab. under stones on downs. (*Hemerg*, 1813.)

Animal blackish red, shining; lateral lobes large, rounded.

Dr. Fleming, who first described this shell, confounded it with *Pupa obtusa* of Drap., but he observed that it is not a line in length, while Draparnaud's shell is about half an inch; this has only five whorls, and his has eight. It was sent to Dr. Fleming by Mr. Chambers, surgeon, Kirkaldy, who found it in the parish of Balmenna, Fifeshire.

Mr. Forbes states that this is the *Pupa obtusa* described by Dr. Fleming; for he has "a specimen which belonged to Captain Laskey, so labelled by himself." Mr. Jeffreys has referred it, as a synonym, to *Pupa alpestris.*

76. 3. VERTIGO *pygmæa.* Pygmy Whorl Shell. — Shell egg-shaped, rather ventricose, bald, shining, reddish brown; whorls four or five; mouth orbicular lunate, with five teeth, one of which is superior and central between the lips of the peristome; the peristome acute, margined externally. (t. 7. f. 83.)

Vertigo vulgaris. *Leach, Syn. Moll.* 93. — Pupa pygmæa. *Drap. Tab. Moll.* 57., *Hist.* p. 60. t. 3. f. 30, 31.; *Forbes and Hanley, B. Moll.* iv. 106. t. 130. f. 4, 5. — Vertigo pygmæa. *Férus. Tab. Moll.* 64.; *Turton, Man.* ed. 1. f. 83.; *Alder, Mag. Zool. and Bot.* ii. 112.; *Moq. Tand. M. F.* ii. 405. t. 28. f. 37—42. t. 29. f. 1—3. — Helix isthmia cylindrica. *Gray, Med. Repos.* 1821, 239. — Turbo sexdentatus jun. *Montag. T. B.* 337.—Alæa vulgaris. *Jeffreys, Linn. Trans.* xvi. 359. — Vertigo quinquedentata, and V. quadridentata. *Studer, Schw. Conch.*—Pupa quinquedentata, and P. pygmæa. *Hartm. N. Alpina,* i. 219. — Alæa pygmæa. *Beck, Ind.* 85. —Stomodonta pygmæa. *Mermett, Moll. Pyr.* 55.

On dry barren hills, under stones.

Animal blackish grey; tentacles very short; labial lobes very long; jaw slender, with a very slight central prominence.

Shell a line long, dark brown, semitransparent; spire composed of five rounded and nearly smooth volutions; aperture somewhat triangular, with usually five teeth, two on each lip, and a central one on the upper part; peristome thin, whitish when the shell is perfect, slightly reflected and forming an

umbilicus, with a longitudinal external rib on the outer lip.

77. 4. VERTIGO *alpestris.* Alpine Whorl Shell. — Shell cylindrical, pale horn-colour, transparent, striolate, with five whorls a little rounded; aperture semicircular, outer lip slightly bent and reflected; teeth four, situated as in *V. pygmæa.* (t. 12. f. 141.)

Vertigo alpestris. *Férussac, MSS.*; *Alder, Mag. Zool. and Bot.* ii. 112. — Pupa pygmæa, var. *Forbes and Hanley, B. M.* iv. 106. t. 130. f. 6.

Inhab. old walls.

Differs from *V. pygmæa*, to which it is very like, in being more cylindrical and slightly striated. The teeth somewhat narrow and the colour more fulvous. The shell is about one tenth of an inch long, half as broad.

78. 5. VERTIGO *substriata.* Six-toothed Whorl Shell.—Shell subcylindrical, ventricose, shining, striated, yellow horn-colour; mouth orbicular lunate, rather sinuated, with two or three plaits on the pillar, and three on the outer lip. (t. 7. f. 84.)

Turbo sexdentatus. *Montagu, T. B.* t. 12. f. 8.; *Sheppard, Linn. Trans.* xiv. 156. — Vertigo similis. *Férussac, Prod.* 64. — Pupa sexdentata. *Alder, Trans. North*, i. 34. — Pupa substriata. *Alder, Cat.* ii. 339.; *Forbes and Hanley, B. M.* iv. 108. t. 130. f. 3. — Alæa substriata. *Jeffreys, Linn. Trans.* xvi. 315. — Vertigo substriata. *Alder, Cat. Supp.*, and *Mag. Zool. and Bot.* ii. 112.; *Gray, Man.* 202.—Vertigo sexdentata. *Turton, Man.* ed. 1. t. 7. f. 84.—Vertigo curta. *Held. Isis*, 1837, 304.

Inhab. marshy places, at the roots of grass, and

under stones; Suffolk, north of England, Preston, Newcastle.

Animal blackish grey.

Shell somewhat smaller than *V. pygmæa*, and of a more conical shape, with the volutions (four or five) more rounded and better defined; and may be readily known by the two distinct teeth on the surface between the two lips on the upper part of the aperture, the right tooth much the larger. The tip is mostly shining; mouth slightly margined externally; peristome thin, reflexed; perforation small.

The figure (84.) of the first edition, did not well represent this species, which is the smallest of the tribe; it has neither the striæ nor the more rounded whorls which distinguish it.

Dr. Turton refers Montagu's *T.* 6-*dentatus* to this species; Mr. Jeffreys refers it to *V. palustris.*

79. 6. VERTIGO *antivertigo.* Marsh Whorl Shell. —Shell oval, ventricose, shining, brown; whorls five; aperture orbicular lunate; margins externally sinuated, with eight unequal teeth, three of which are superior and between the lips of the peristome. (t. 7. f. 85.)

Pupa antivertigo. *Drap. Tabl. Moll.* 57.; *Hist.* p. 60. t. 3. f. 32, 33.; *Forbes and Hanley, B. M.* iv. 109. t. 130. f. 7. — Vertigo palustris. *Turton, Man.* 104.; *Leach, Moll. Syn.* 93. t. 8. f. 10. — Alæa palustris. *Jeffreys, Linn. Trans.* xvi. 360. — Vertigo Montagua. *Leach, MSS.* — Helix septemdentata. *Férus. Prod.* 64.; *Rossm. Icon.* x. f. 647. — Pupa vertigo, var. α and γ. *Hartm. N. Alp.* i. 219. — Pupa octodentata. *Hartm. N. Alp.* i. 219. — Vertigo sexdentata. *C. Pfeiff. D. Moll.* i. 71. t. 3. f. 43, 44. — Vertigo antivertigo. *Michaud, M. F.* 72. — Alæa antivertigo. *Beck, Ind.* 85. — Stomodonta antivertigo. *Mermet, Moll. Pyr.* 54.

Inhab. marshy situations, on *Isolepis fluctuans*. (*Gray*, 1817.)

Animal grey-black and shining; upper tentacles short, inflated at the base, lower dot-like; front of head proboscis-like.

Shell smaller than the last, of a deep chestnut-brown colour, with the margin of the aperture whitish; teeth three above and three below, and one on each side, and often a ninth tubercular tooth.

It may easily be distinguished by the three very discernible white teeth of unequal size within the upper and truncated part of the aperture, whereas there is only a single central one apparently visible in the same position in *V. pygmæa*, and two in *V. substriata*. The mouth varies with from six to nine teeth.

b. *Shell cylindrical fusiform, sinistral; mouth margined externally.* (Vertigo *Müller*. Vertilla *Moq. Tand.*)

80. 7. VERTIGO *pusilla*. Wry-necked Whorl Shell. — Shell ventricose, attenuated, bald, rather shining, very brittle, pale brown; whorls five; mouth subquadrate, rounded beneath; plaits six or seven, white, two or three on the column, and four on the lips; peristome thin; umbilicus rather narrow. (t. 7. f. 86.)

Vertigo pusilla. *Müller, Verm.* ii. 124.; *Alder, Mag. Zool. and Bot.* ii. 112.; *Jeffreys, Linn. Trans.* xvi. 361.—Jaminia heterostropha. *Risso*, iv. p. 91. — Vertigo heterostropha. *Turton, Man.* 105. f. 88.; *Leach, Moll. Syn.* 94. — Pupa Vertigo. *Drap. Tabl.* 57., *Hist. Moll.* p. 61. t. 3. f. 34, 35. — Pupa pusilla. *L. Pfeiffer, Mon. H.* ii. 364.; *Forbes and Hanley, B. M.* iv. 111. t. 130. f. 8. — Helix Vertigo. *Gmel. S. N.* 3664. — Turbo Vertigo, var. *Mont. T. B.* 365.

Inhab. moist woods, under stones.

Animal grey, paler beneath; foot slender.

Shell half a line long, pale chestnut-brown, semi-transparent, striolate; spire composed of five much rounded volutions; aperture reversed, somewhat triangular, obliquely truncate, with the peristome thin, white, and slightly reflected, forming an umbilicus behind the pillar; behind the outer lip is a longitudinal rib, and two or three transverse pale lines, being the reflection of the internal teeth; teeth two above, and five round the mouth, with sometimes an eighth tooth on the pillar lip.

81. 8. VERTIGO *angustior*. Narrow Whorl Shell. — Shell ventricose, barrel-shaped, pale fulvous, very slightly and sharply striated; whorls four or five, last broad; mouth sub-triangular; teeth four or five, two on the column and two or three on the outer lip; peristome rather thickened. (t. 12. f. 142.)

Turbo Vertigo. *Mont. Test. Brit.* 363. t. 12. f. 6. (not var.) — Vertigo angustior. *Jeffreys*, *Linn. Trans.* xvi. 361.; *Alder*, *Mag. Zool. and Bot.* ii. 112.; *Gray*, *Man.* 205. — Vertigo Venetzii. *Charpent.*; *Denke*, *Schw.* 18. t. 2. f. 11.; *Rossm. Icon.* x. f. 650.—Pupa Venetzii. *L. Pfeiffer*, *Helic.* ii. 264.; *Forbes and Hanley*, *B. M.* iv. 112. t. 130. f. 9. — Vertigo hamata. *Held. Isis*, 1837, 304. (?) — Vertigo plicata. *A. Müller*, *Wiegm. Arch. N.* 1838, 210. t. 4. f. 6.; *Moq. Tand. M. F.* ii. 408. t. 29. f. 8. 11.

Inhab. rejectamenta of a small stream at Marino, near Swansea.

Mr. Jeffreys observes, besides the very different contour and more contracted aperture of this shell, the circumstance of the back being more sunk in

some specimens than in others, which peculiarity denotes the growth of dentate shells, sufficiently refutes the idea of its being the young of *V. pusilla.*

Mr. Alder observes that the difference between this species and *V. pusilla* appears to be more in the number of the teeth than in the colour of the shell; and if the former is permanent, it is undoubtedly the better character of the two. He further remarks, "I have some doubt about this species: I examined Mr. Jeffreys' specimen, but could not satisfy myself of its distinctness from *V. pusilla:* I take it upon faith."

After considerable inquiries and correspondence, I have not been able to procure a specimen of this species, to examine or figure; and thence I cannot offer any opinion on the subject of its distinctness.

Captain Brown has added to the list *Pupa labiata* Brown, B. S. t. 41. f. 7.; but the figures are so indistinct that I cannot determine them.

### 12. Balea. (Moss Shell.)

The animal is like *Bulimus*; but the shell is reversed, thin, with an elongated taper spire, the last volution larger than the next; aperture roundish-oval, entire at the base, oblique, with a single tooth on the pillar, which is wanting in the young shells, and the pillar is destitute of any valve-like plait or *clausium;* jaw lunate, narrow, scarcely crenulated.

This shell is often mistaken for a young unformed specimen of *Clausilia;* but it may be known from

those shells by the front of the last whorl being convex and simple, and not flattened and furnished with a keeled ridge near the outer edge, as is the case with the young of all the species of that genus.

From *Bulimus* and *Pupa* this genus is distinguished by the aperture being left-handed; from *Clausilia*, in having the ultimate volution proportionately larger than the next; and from *Vertigo*, in the regularity of its mouth.

Draparnaud erroneously describes this shell as having a *clausium*. (See *Férussac, Essai*, iii.)

82. 1. BALEA *perversa*. Fragile Moss Shell. — Shell rather linear-oval, transparent yellowish; whorls six or seven; mouth subquadrate. (t. 6. f. 70.)

Turbo perversus. *Linn. S. N.* 1240.; *Mont.* p. 335. t. 11. f. 12., *Supp.* 131. — Pupa fragilis. *Drap. Hist.* p. 68. t. 4. f. 4. — Clausilia fragilis. *Féruss. Essai*, 51.; *Studer; Jeffreys, Linn. Trans.* xvi. 351. — Balæa fragilis. *Leach, Moll.* p. 116.; *Alder, Cat.* 8. 427.; *Mag. Zool. and Bot.* ii. 111.; *Forbes and Hanley, B. M.* iv. 114. t. 128. f. 8, 9. — Balea fragilis. *Gray, Zool. Journ.* i. p. 61.; *Rossm. Icon.* x. f. 638. —Balea perversa. *Leach, Syn. Moll.* 83.; *Flem. B. A.* 271. — Clausilia uniplicata. *Calcara*, 82. — Odostomia perversa. *Flem. Ed. Ency.* vii. 76. — Pupa perversa. *Moq. Tand Moll. F.* ii. 349. t. 25. f. 6. 14.—Bulimus perversus. *Poiret, Prod.* 57. — Clausilia parvula. *Gärt. Conch. Wett.* 22. — —Clausilia perversa. *Charpent.* — Fusulus fragilis. *Fitz. Syst.* 108. — Stomodonta fragilis. *Mermett, Moll. Pyr.* 43.

On the trunks of trees, under the bark, and embedded in the lichen; also in the fissures of rocks.

Animal brownish yellow; neck black; foot grey, granular, spotted, narrow, and elongate; tentacles—upper thick, short, clavate,—lower scarcely visible, very small, tubercular; muzzle very blunt and large.

Shell about a quarter of an inch long, slender, and tapering to a rather sharp point, transparent yellowish horn-colour, slightly striate longitudinally; spire consisting of from six to nine raised and well-defined volutions; aperture roundish-oval; the peristome thin, simple, and a little reflected at the pillar, so as to form a slight umbilicus. In old and full-grown shells there may be observed a slight fold or tooth about the middle of the pillar, but which is seldom to be met with.

These shells vary considerably in their size, colour, and shape, some being more ventricose than others. Mr. Jeffreys, probably forgetting that these animals are all hermaphrodite, observes, "The females have their shells much more ventricose and with fewer volutions." (*Linn. Trans.* xvi. 351.)

### 13. Clausilia. (Close Shell.)

The animal like *Bulimus;* but the shell is reversed, with an elongated, slender, fusiform spire, the last volution less tumid than the one before it, with an obtuse or papillary summit; aperture oval, oblique, united all round and margined, toothed; throat furnished with an internal spiral shelly plait, or *clausium*, fixed on an elastic pedicle, which closes the cavity when the animal is withdrawn.

Jaw lunate, narrow, with a slight central prominence, nearly smooth.

The elegant spindle-shaped outline of the shell of this family having the last volution slenderer than the

one above it, and being consequently more tumid above the aperture, fixes its distinction from *Bulimus*, as well as the peculiarity of the appendage.

The *clausium* or peculiar elastic valve in the last whorl of these shells was first noticed by D'Aubenton, in his *Distribution Méthodique des Coquillages*, in the *Mémoires de l'Académie des Sciences de Paris*, and accurately described by Otho F. Müller, in his excellent *Historia Vermium*, &c., in 1773, and by him called *ossicula* and *scala*. He beautifully and accurately described its peculiar functions.

Draparnaud has since described it as a new discovery, having overlooked Müller's account, though he frequently quotes his work. Cuvier, in his *Règne Animal*, iii. 45., speaks of it, but says he does not know its use to the animal.

In the *Annals of Philosophy* for 1822, Mr. Miller, who also appears not to have seen Müller's description — for he specially tells us that he discovered it in 1814, and showed it to Dr. Leach in the following year, before Draparnaud published his account of it, — gives the following interesting account of its mechanism:—

"Independently of the various contrivances which nature has resorted to for the protection of the otherwise easily vulnerable Mollusca, it has taken peculiar care to guard the apertures of many univalves from the intrusion of enemies; hence the apertures are sometimes peculiarly contracted and provided with numerous folds and teeth. Other Mollusca have a calcareous operculum permanently formed, which increases in thickness, and enlarges on a depressed

spiral plane, as the opening of the shell extends with the growth of the animal, thus continually assimilating to its size, and when the animal retreats, excluding it completely from all external intrusion. In the *Clausilia*, nature has continued the protection afforded by means of contractions and folds, and also added an opercular appendage. The inhabitant of the *Clausilia*, when nearly full-grown, secretes a thread-like elastic calcareous filament, one of whose ends is affixed to the columella. This filament makes half a spiral turn round the columella, insinuating between its folds. When the animal finishes its shell and completes the aperture, it secretes, at the unattached end of the filament, a spoon-shaped calcareous lamina conforming at its margin to the contour of the aperture. The lamina is somewhat smaller than this, and its margin is rounded.

"Its adhesion to an elastic filament enables the animal to push it, when it comes out of its shell, against the columella; and the same elasticity closes it on the inhabitant retreating, thus securing it from intruding enemies. Thus, then, this valve may be compared to a door provided with an elastic spring. The elasticity of the filament may be restored to its full power (in the empty shell) by sometimes immersing it in water, as I have ascertained in a section made with a view to this inquiry." (*Ann. Phil.* iii. 378.)

Draparnaud has named this valve-like appendage the *clausium;* and Cuvier (*Règne Animal*, ii. 409.) states, "de cette lame on ignore l'usage dans l'animal vivant."

In my "Conchological Observations" (*Zoological Journal*, i. 212.) I gave the following more particular account of this appendage:—

"Of all the wonderful contrivances employed by nature for the protection of the Mollusca, there is none which is more calculated to excite the admiration of the conchologist than the *clausium*, an elastic appendage which closes the aperture of the *Clausiliæ*. It consists of a spirally twisted thin shelly plate, inclosed in the last whorl of the shell, and attached to the columella by an elastic pedicle. When the animal is retracted within its shell, this shelly plate nearly covers the aperture at a little distance within the mouth, and coming in contact with a transverse plait on the outer lip, leaves only a small canal, formed between the outer plait and the posterior angle of the mouth, and sometimes an elongated longitudinal plait on the inner lip. When the animal wishes to protrude itself, it pushes the plate on one side into a groove situated between the inner plait and the columella, where it is detained by the pressure of the body of the animal, leaving the aperture free; and when the animal withdraws itself, the plate springs forward by the elasticity of its pedicle, and closes the aperture. This curious structure, and also the plaits of the mouth, which are intimately connected with it, are not formed until the animal has nearly reached maturity. It is best exhibited by breaking off the outer part of the aperture to the distance of about half a whorl, when it will generally be found free; but in order to exhibit it behind the columella in its natural position, when the animal is exserted,

it is necessary to kill the animal in that situation (by drowning it), and then suffer it to dry before the outer lip is broken off; and the pedicle will thus become fastened to the side by means of the dried mucus (of the body): it may, however, at any time be relaxed by a little moisture, when it will instantly resume its elasticity, and spring from its attachment."

I cannot agree with Dr. Louis Pfeiffer in regarding the *clausium* of *Clausilia* as "evidently analogous to the operculum of several molluscous genera." *First*, it is not attached to the animal, as the operculum always is, but is a mere appendage to the mouth of the shell. *Secondly*, it is only formed when the animal has nearly reached its full growth, when it is about to complete the mouth of its shell, and not developed in the embryo of the animal while yet in the egg, as is the case with the operculum. *Thirdly*, the genus belongs to a group of Mollusca which are never operculated.

From the above considerations I have always regarded the *clausium* as a peculiar modification of a tooth or plait. I think that when its position, use, and mode of formation are considered, this will be found to be the case. If this be correct, I do not see how the genus *Clausilia* is to be separated, according to Dr. L. Pfeiffer's views, from *Bulimus;* and as *Cylindrella Chemnitziana* has an ovate mouth, the sinistral whorls of *Clausilia*, and incloses a rudimentary *clausium*, it will be necessary, if his views are carried out, to unite his genus *Cylindrella* to the same group. (*Gray, Ann. and Mag. N. H.* iii. 244. 1840.)

Montagu, who described the animals of all the species he knew, enters into a long explanation respecting the difference between sinistral, or reversed, and dextral shells. Formerly, all reversed shells were considered as monstrosities; but now it is well known that some species which are generally dextral, are often found reversed; and this monstrosity consists not only in the shell being turned in the contrary direction down the imaginary axis, but the animal itself has all the organs placed on the opposite side of the body. There are some few Mollusca which appear to be very liable to this monstrosity, as *Bulimus aureus*, *Pyrula perversa*, and the whole genera of *Clausilia* and *Physa*, the natural character of which is to be reversed. It would be a monstrosity in them to find them dextral or twisted in the same direction as other shells. (See *Phil. Trans.* 1833.)

a. *Clausium notched at the tip, fitting into a plait on the outer lip of the shell; shell smooth.* (Marpessa *Gray.*)

88. 1. Clausilia *bidens*. Laminated Close Shell. — Shell nearly smooth, glossy, and transparent; aperture with two white plaits; clausium emarginate. (t. 5. f. 53.)

Helix bidens. *Müller*, *Verm.* ii. 116. (not *Linn.*). — Bulimus bidens. *Brug. E. M.* 352. — Turbo laminatus. *Mont.* p. 359. t. 11. f. 4. — Clausilia bidens. *Drap.* p. 68. t. 4. f. 5—7.; *Brard*, p. 83. t. 3. f. 9.; *Alder*, *Mag. Zool. and Bot.* ii. 110.; *Pfeiffer*, 60. t. 3. f. 25.; *Rossm. Icon.* i. 76. t. 2. f. 29. — Clausilia lamellata. *Leach*, *Moll. Syn.* 85. — Helix (Cochlodina) derugata. *Fér. Tab.* 63. — Clausilia laminata. *Turton*, *Man.* ed. 1. 70. f. 53.; *Moquin Tand.*

*Moll. Franc.* ii. 348. t. 23. f. 2—9.—Turbo bidens. *Chemn. C.* ix. 119. f. 960. n. 1.; *Penn. B. Z.* 131.—Turbo perversus, var. *Pulteney, Dors.* 46.—Pupa bidens. *Drap. Tabl.* 61.—Clausilia derugata. *Jeffreys, Linn. Trans.* xvi. 354.—Clausilia lucida. *Menke, Syn.* 129.—Clausilia ungulata. *Beck.*—Odostomia laminata. *Flem. E. Ency.* vii. 67.

In beech woods, among decayed leaves, and on the bark of trees, especially in a chalky soil.

Animal pale fulvous; upper tentacles long, clavate. (*Sturm, Fauna*, t. .)

Shell half an inch long, of a glossy reddish horn-colour and nearly smooth; spire composed of twelve raised volutions; aperture roundish-oval with a white thick margin attached at the upper part of the body volution, with two laminar folds, one of them straight and placed near the top of the aperture and almost central, the other curved and in the middle of the pillar lip, frequently crenate; and deep within the mouth are three or four permanent ridges which are visible on the back at the outside when held before a strong light.

Varies greatly in size, ventricoseness, and colour, being sometimes greenish white and transparent.

Montagu (*Test. Brit.* 359.) considered the white variety as a shell deprived of its brown epidermis, but the periostracum is as distinct on the greenish white shell as on the brown specimen; both the shell and the periostracum are differently coloured, or rather uncoloured in that variety, from the absence of the colouring matter.

Dr. Turton, by an oversight, first describes the operculum as emarginate, and then makes his third

variety to be characterised by the internal lamina being notched.

b. *Clausium entire at the top; shell corrugated.* (Iphigenia *Gray.*)

84. 2. CLAUSILIA *biplicata.* Folded Close Shell.—Shell ventricose, opaque grey-brown, with regular raised striæ; aperture with two plaits, the margin detached all round. (t. 5. f. 55.)

Turbo biplicatus. *Mont.* p. 361. t. 11. f. 5. — Clausilia ventricosa. *C. Pfeiffer, D. Moll.* i. 63. t. 3. f. 29.; *Drap.* p. 71. t. 4. f. 14.; *Jeffreys, Linn. Trans.* xvi. 354.—Clausilia biplicata. *Leach, Moll.; C. Pfeiffer, D. Moll.* i. 63. t. 3. f. 27.; *Forbes and Hanley, B. M.* iv. 118. t. 129. f. 4.—Clausilia Montagui. *Gray, Ann. Phil.* 1825, 413.—Helix perversa, adult. *Müller, Verm.* ii. 118. (?)—Helix (Cochlodina) ventricosula. *Féruss. Tab.* 63. — Clausilia similis. *Charpent.* in *Rossm. Icon.* i. 77. f. 30., vii. f. 168., xi. f. 705, 706.; *Gray, Ann. Phil.* 1825, 413. — Cochlodina similis. *Férussac?* — Clausilia plicata. *Gärt. Wett. Conch.* 22. — C. perversa. *C. Pfeiffer, D. Moll.* i. 63. t. 3. f. 29.— Odostomia biplicata. *Flem. E. Ency.* vii. 77.—Clausilia vivipara. *Held. Isis,* 1837, 319.—Clausilia cordata; C. vulnerata; C. infulæformis; C. radicans; C. rostrata; and C. quadrata. *Forst. N. Act. Leop.* xix. 269—275. t. 58. f. 1—6. 1841.

In woods and close hedges.

Animal dark grey.

Shell nearly three quarters of an inch long, dark grey, opaque, regularly striate longitudinally; spire consisting of eleven or twelve rather fat but well-defined volutions; the suture a depressed line; aperture oval, a little sinuous at the upper and inner angle, with two plaits, one near the top of the pillar lip, and the other not quite halfway down, both of them approaching each other as they recede inwardly;

the margin white, and detached all round. Varies with one or two additional minute denticles in the mouth.

M. Férussac originally referred *T. biplicatus* Mont. to *C. ventricosa* Drap.; but he afterwards adopted the opinion that they were distinct. The British shell is more slender and spindle-shaped than the French; they are, perhaps, only local varieties; but it is extremely difficult to define the species of this genus.

This species was first described as British by Montagu.

85. 3. CLAUSILIA *Rolphii*. Rolph's Close Shell.— Shell ventricose, thin, opaque, red-brown, with regular crowded raised striæ; aperture with four or five plaits, two of which are longer. (t. 5. f. 54.)

Clausilia (Iphigenia) Rolphii. *Gray, Med. Repos.* 1821, 182. — Clausilia Rolphii. *Leach*, in *Gray, Ann. Phil.* 1825, 413.; *Férussac, Journ. Phys.* 1820, 301.; *Leach, Syn. Moll.* 86. t. 8. f. 9.; *Alder, Mag. Zool. and Bot.* ii. 111.; *Turton, Man.* ed. 1. 71. f. 54.; *Moq. Tand. Moll. Franc.* ii. 343. t. 24. f. 32—39. — Clausilia plicatula. *Drap. Hist.* p. 74. t. 4. 17, 18.?; *Brard*, p. 85. t. 3. f. 10.?; *Jeffreys, Linn. Trans.* xvi. 353.; *Rossm. Icon.* i. p. 39. f. 32., vii. f. 471—475.; *Forst. N. Act. Leop.* xix. t. 58. f. 7.; *Forbes and Hanley, B. M.* iv. 120. t. 129. f. 3. — Turbo controversus. *Alten, Augsb.* 18. t. 2. f. 3. — Stomodonta plicatula. *Mermett, Moll. Pyr.* 47. — Clausilia Mortelleti. *Dumont*, 1853; *Schmidt, Ann. and Mag. N. H.* xvii. 10. 1856; *Prentice, Ann. and Mag. N. H.* xviii. 446.

In damp places in woods, among the moss and stones, under nettles and dogs' mercury, and on trunks of trees, on a chalky soil. (*Mr. Rolph*, 1817.)

Animal grey.

Shell an inch long, of a greyish brown horn-colour, tumid in the middle; spire composed of ten or eleven rather swollen volutions, which are marked with regular raised longitudinal lines; aperture roundish-oval, sinuous at the upper and outer angle; the margin thick, white, detached all round, with four or five plaits, two of which are much longer than the rest.

Like other species, it is sometimes found transparent and colourless.

86. 4. CLAUSILIA *nigricans*. Dark Close Shell.—Shell slender, sub-opaque, black-brown, with fine raised somewhat granular striæ; aperture with three plaits, the margin white and detached all round. (t. 5. f. 58, 59.; t. 12. f. 143.)

Turbo bidens. *Montagu*, p. 357. t. 11. f. 7. (not *Linn.*) — Clausilia rugosa. *Drap.* p. 73. t. 4. f. 19, 20.; *Leach, Syn. Moll.* 87.—Turbo nigricans. *Maton and Racket, Linn. Trans.* viii. 180.; *Mont. T. B. Supp.* 131.; *Dillw.* 375.; *Pult. Dorset.* 46.; *Turt. Dict.* 225.—Odostomia nigricans. *Flem. Ed. Ency.* vii. 70.—Helix perversa. *Müller, Verm.* 118.—Bulimus perversus. *Brug.*—Turbo perversus. *Penn. Brit. Zool.* iv. t. 82. f. 116.; *Pulteney, Dorset.* 46., part.—Clausilia nigricans. *Jeffreys, Linn. Trans.* xvi. 351.; *Gray, Man.* 217.; *Forbes and Hanley, B. M.* iv. 121. t. 129. f. 1, 2.—Clausilia roscida; C. cruciata. *Studer, Schw. Conch.* 20.—Clausilia perversa. *Flem. B. A.* 271.—Strombiformis perversa, young. *Da Costa, B. C.* 187.—Clausilia rugosa, and C. obtusa. *C. Pfeiffer, D. Moll.* i. 63. 65. t. 3. f. 30. 33, 34.

Var 1., smaller, more slender (t. 5. f. 58.): Clausilia parvula. *Leach, MSS., B. M.; Turton, Zool. Journ.* ii. 556., *Man.* ed. 1. 74. f. 58.; *Jeffreys, Linn. Trans.* xvi. 352. (not *Studer*).

Var. 2., shorter, fewer whorls: Clausilia Everettii. *Miller*, *Ann. Phil.*, n. s., xix. 377. 1822.

Var. 3., larger, more ventricose (t. 12. f. 143.): Clausilia dubia. *Drap. Hist.* 70. t. 4. f. 10.; *Alder*, *Cat. Supp.* 3., *Mag. Zool. and Bot.* ii. 111.; *Gray*, *Man.* 216. t. 12. f. 143. — Clausilia crassula. *Potiez and Mich. Cat.* i. 180. t. 18. f. 8—10.? —Clausilia rugosa, var. *Alder*, *Cat.* 32.; *Forbes and Hanley*, *Brit. Moll.* 121. — Clausilia similis. *Gilbertson*, *MSS. B. M.* (not *Fér.*).

Common under stones and in old walls.

Animal brown, corrugated, foot narrow.

Shell about half an inch long, glossy black or grey, often marked with short cinereous streaks, with regular raised lines, which, when closely examined, appear a little granular; spire composed of from seven to ten rather raised volutions; aperture oval, with the inner lip a little contracted, with three plaits, all on the pillar, the lower one interior and hardly distinguishable in the full-grown shell; the margin thick and white, but not reflected, detached all round.

This very common species varies greatly in size, in the slenderness and ventricoseness of the shell, and in the strength or slightness of the concentric striæ; but in a large series all these varieties gradually and uninterruptedly pass into one another, and they may all be found in specimens collected from the same locality. It is also rarely found transparent and colourless. Mr. Jeffreys describes a distorted specimen, with a prominent medial ridge down the whorls.

Mr. Alder has kindly communicated to me "a specimen of the shell he sent to Dr. Turton, which

Dr. Turton calls *C. parvula* (t. 5. f. 59.); and also the specimens of the true *C. parvula* (according to Férussac) found in Germany, for comparison." He further observes that all the British specimens he has seen, he thinks, are only varieties of *C. nigricans*, which, I think, the specimen fully bears out.

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### Sub-order III. *Limnophila.*

Eyes sessile; tentacles two, subcylindrical or flattened, simply contractile; operculum none. The organs of generation with separate external openings sometimes close together. Fluviatile.

The male and female organs of these animals are more distinctly developed; in this respect they appear to be intermediate between the hermaphrodite *Geophila* and the unisexual Gasteropods.

### Fam. 4. AURICULIDÆ.

The animal with an elongated foot, an elongate ringed muzzle, two subcylindrical tentacles, with the eyes near the inner hinder side of their base; body spiral, placed on the centre of the foot, and covered with a thin mantle with a thickened edge, which is itself covered with an external spiral shell, which has a plaited pillar in all its ages.

These Mollusca appear, by habit and character, to be exactly intermediate between the land and

the fresh-water Univalve Mollusca. They have the sessile eyes of the Pond-snails, placed behind instead of in front of the tentacles, and the subcylindrical tentacles of the Land-snails; but the tentacles are not retractile under the skin of the neck. In the same manner the *Carychia* and the *Acmea* are terrestrial, living in damp moss; the *Conovuli* live in the mud at the mouths of rivers, or in the sea — they seldom leave salt or at least brackish water. There are some foreign species which live in ponds, and have all the habits of our Pond-snails, only their pillar is more distinctly plaited.

Montagu observes: "A remarkable character of this shell (*Voluta denticulata*) is that the columella extends no further than the upper part of the body volution, the superior spires (whorls) being destitute of any pillar or internal spiral division." This peculiarity is common to most species of this family, and is one of its best conchological characters: the absence is generally caused by the animal absorbing the septa which separate the upper whorls, and thus converting the spire into a single cavity, as it enlarges the shell at the edges of the mouth below. In *Scarabus*, the septa between the whorls appear to be originally formed imperfect. (See *Phil. Trans.* 1833.)

Many of the animals of this family rest in their growth, and form a more or less complete new mouth after they have formed half a whorl to the shell. This is most easily observed in the genus *Scarabus*, where the varices form a ridge down each side of the shell, as in the marine genus *Apollon*. It is to

be seen obscurely indicated in some *Ophicardelli* and the other genera.

This family contains only two British genera: —

1. *Carychium.* Shell ovate; mouth oblong, three-toothed; peristome reflexed. (p. 219. f. 1, 2.)
2. *Conovulus.* Shell ovate; mouth linear; pillar with two or three plaits. (p. 219. f. 4, 5.)

### 1. Carychium *Müller.* (Carychium.)

Shell spiral, thin, conic-ovate; mouth oblong, longitudinal, two- or three-toothed, compressed, rather oblique, rounder at each end; peristome interrupted, thickened and rather reflexed. (p. 219. f. 2.)

*Fig.* 45.

87. 1. Carychium *minimum.* Minute Sedge Shell. (t. 7. f. 77.)

Carychium minimum. *Müller, Verm.* ii. 125.; *Jeffreys, L. T.* xvi. 365.; *Leach, Syn. Moll.* 95.; *Forbes and Hanley, B. M.* iv. 198. t. 125. f. 8. — Turbo Carychium. *Mont.* p. 339. t. 22. f. 2., *Linn. Trans.* viii. 184. — Auricella Carychium. *Hartmann*, in *Sturm, Fauna*, vii. t. 1. — Auricula minima. *Drap.* p. 57. t. 3. f. 18, 19. — Odostomia Carychium. *Flem. Ed. Ency.* vii. 76. — Helix Carychium. *Gmel. S. M.* i. 3665. — Bulimus minimus. *Poiret, Prod.* — Seraphia tridentata. *Risso, Eur. Merid.* iv. 84. — Carychium minutissimum. *Férussac.*

At the roots of grass and moss in moist places. (*Mr. Boys.*)

The animal is yellowish white, with only two short cylindrical, blunt, or truncated tentacles, at the base of which, between or nearly behind them, are placed two very conspicuous approximating black eyes.

(p. 219. f. 1, 2. *Montagu, T. B.* 340.; *Sturm*, t. 1. f. 3.)

Shell hardly the tenth of an inch long, conic, white, shining, with a yellowish cast, transparent; spire composed of five rounded volutions, very finely striate longitudinally, and ending rather obtusely; aperture semioval or rather ear-shaped, rounded at both the ends, with two teeth on the pillar, and sometimes a small one above the others; the margin thick, and in the middle of the outer lip a thick tooth-like protuberance.

### 2. Conovulus. (Conovulus.)

Shell oval, obconic; last whorl long, compressed; mouth linear; pillar with two or three spiral plaits; outer lip simple or very slightly reflexed; throat grooved.

The foot of the animal is obovate, oblong, blunt in front and behind; tentacles contractile, filiform, slightly ringed; eyes at their inner base; muzzle porrect, notched in front, as in *Limnæus;* mantle closed all round, with the exception of a perforation at the point of junction of the outer and inner lip. The pillar of the shell is plaited in all ages.

*Fig.* 46.

*Conovulus denticulatus.*

The animal, in habit, manner, and appearance, very greatly resembles that of *Aplexa* or *Limnæus*, but differs in the tentacles being filiform and ringed.

They live in brackish water and salt-water marshes, at the roots of rushes, and are sometimes found under stones on the sea-shore near the mouths of rivers.

Mr. Lowe (*Zool. Journ.* iv. 280.) at one time thought that the animal might be ptenobranchous; but he has since seen reason to doubt this conclusion; and the question has been settled by Mr. Berkeley's admirable observations and figures of the animal. (*Zool. Journ.* v. 429. t. 19. f. 3.)

On account of the marine or semimarine habit of most of the species of this genus, they were not noticed by Dr. Turton in the first edition of this Manual; but as they are the only British *Pneumonobranchiata* which inhabit such places, and as I have found *C. denticulata* high up the Thames, I have been induced to insert them.

a. *Pillar 3- or 5-plaited; mouth toothed; peristome slightly reflexed.* (Ovatella *Bivona.*) Paludinal, or marine.

88. 1. Conovulus *denticulatus.* Denticulated Conovulus. — Shell oblong, brittle, smooth, brown or purplish; spire conical, ciliated; mouth oblong, rather thickened; pillar three- or five-plaited. (p. 219. f. 4, 5.) (t. 12. f. 144.)

Turbo bidentatus. *Walker, Test. Min. Rar.* f. 50. and 53. — Voluta denticulata. *Mont. Test. Brit.* 234. t. 20. f. 5.; *Berkeley, Zool. Journ.* v. t. 19. f. 3., animal. — Voluta ringens. *Turton, Conch. Dict.* 250. — Voluta reflexa. *Turton, Conch. Dict.* 250. — Auricula myosotis. *Jeffreys, Linn. Trans.* xvi. 368. (not *Drap.*) — Alexia personata. *Adams, P.* f. 5. 1854. — Acteon denticulatus. *Fleming, B. A.* 337.

— Auricula personata. *Pot. and Mich. Cat.* i. 250.; *Desh. Lam.* ed. 2. viii. 332. — Carychium personatum. *Mich. Compl.* 73. t. 15. f. 42, 43. — Carychium (Phytia) myosotis. *Moq. Tand. M. F.* ii. 417. t. 29. f. 33—39. t. 30. f. 1—4. — Auricula ciliata. *Morelet, Moll. Portug.* 77. t. 7. f. 4.—Alexia ciliata. *Pfeiff. Aur.* 150.—Auricula myosotis, var. *a. Féruss. Prod.* 103. — Auricula denticulata. *Jeffreys, Linn. Trans.* xvi. 367. — Auricula tenella. *Menke, Syn.* 131. — Pythia denticulata. *Beck, Ind.* — Conovulus denticulatus. *Gray, Man.* 225. f. 144.—Jaminia denticulata, and J. quinquedentata. *Brown.* — Alexia denticulata. *Leach, Syn. Moll.; Pfeiffer, Auricul.* 145. — Carychius (Ovatella) denticulata. *Moq. Tand. M. F.* ii. 415. t. 29. f. 27—29.

Var. myosotis, shell stronger, lips less toothed: Auricula myosotis. *Drap. Hist.* 56. t. 3. f. 16, 17. — Carychium myosotis. *Michaud, Comp.* 73. — Voluta denticulata. *Berkeley, Zool. Jour.* v. 428. — Melampus denticulatus. *Stimps.* t. 19. f. 3. — Auricula denticulata. *Gould, Inv. Massa.* 199. t. 129. — Pythia myosotis. *Gray, Med. Repos.* 1821; *Beck, Ind.* 104.—Conovulus denticulatus, var. myosotis. *Forbes and Hanley, B. M.* t. 125. f. 4, 5.

Inhab. brackish marshes, clefts of rocks near the high-water mark, and in the mud left bare by the tide at the mouths of rivers.

Animal purplish.

The habits of the animal are very like those of *Lymnæus fossarius* and *palustris*, which are sometimes found occupying the same situations a little distance up the river that these animals do at its mouth.

This shell was first recorded as British by Boys, who found it in the marshes near Faversham, at the roots of rushes.

This species varies considerably — 1. In size; 2. In colour, from purplish brown to brownish, while some are also very rarely found nearly hyaline; 3. In the length of the spire and in the ventricose-

ness of the volutions. The mouth is generally strongly toothed; but sometimes it is nearly smooth. The hinder part of the last whorl and the spire of the living or perfect specimen are ciliated near the suture; but the cilia are easily rubbed off in the dry shell. These variations induced Dr. Turton, in his Dictionary, to divide it into three species.

The animal is rather rapid in its movements, irritable, comes out of the shell rather obliquely. The tentacles appear like conical protuberances fixed on the muzzle. In their rapid walking they are assisted by the end of the muzzle, like the Cyclostomes, and carry their shell nearly horizontally.

The *Conovulus denticulatus* feeds on the detritus of marine plants and rotten wood; and lays twelve or thirteen eggs in the months of June and September, united by a viscid matter into a small mass, which is fixed under the more humid stones. The eggs are globular, yellowish, and quite diaphanous: they are hatched about the fifteenth day, and the animals reach their full size about the end of the second year. They do not hybernate.

Mr. Lowe doubts the propriety of referring *Voluta denticulata* to the genus *Melampus*, because he thinks that it has a periostracum, which, he believes, the other wants; but the fact is, they all have it, and in this species it is only rather thicker than in the others. (*Zool. Journ.* iv. 291.)

Montagu (*Test. Brit.*) and Miller (*Ann. Phil.* iii. 777.) truly describe the apex of the shell as being destitute of any septa.

Mr. Jeffreys suspected that *Voluta hyalina* Montagu was only an imperfect specimen of this species: Montagu's specimen is a foreign marine shell not yet arrived at its full growth.

b. *Pillar two-plaited; throat smooth; peristome simple.* (Leuconia.) Marine.

89. 2. CONOVULUS *bidentatus.* Two-toothed Conovulus.—Shell ovate, ventricose, smooth, shining white; spire short; suture indistinct; mouth oblong; two of the plaits of the pillar larger than the rest; peristome slightly thickened and reflexed in front. (t. 12. f. 145, 146.)

Voluta bidentata. *Mont. T. B. Suppl.* 100. t. 30. f. 2.—Auricula bidentata. *Férussac, Tab. Moll.* 103.; *Gray, Ann. Phil.* 15.; *Jeffreys, Linn. Trans.* xvi. 368. (not *Gould*).—Jaminia bidentata. *Leach, Syn. Moll.* 97.—Acteon bidentatus. *Flem. B. A.* 337.—Conovulus bidentatus, and C. alba. *Gray, Man.* 227. t. 12. f. 145, 146.—Auricula Micheli. *Mettre, Rev. Zool.* 1841, 66.—Auricula dubia. *Cantr. Bull. Brux.* ii. 383.—Ovatella bidentata. *Bivona,* 22. t. 2. f. 10. (?)—Auricula myosotis, var. β. *Philippi, Moll. Sicil.* i. 143. (?).

Var. Auricula erosa. *Jeffreys, Linn. Trans.* xvi. 269.

Var. alba, shell and aperture rather narrower, spire rather more produced, lower fold nearly obsolete: t. 12. f. 146. Voluta alba. *Turt. C. Dict.* 250. (not *Montag.* nor *Maton and Racket.*)—Auricula alba. *Féruss. Tab. Moll.; Gray, Ann. Phil.* 1825, 15.—Volvaria alba. *Flem. B. A.* 333.

Inhab. the sea-coast (of Devon), under stones left by the tide.

Animal, according to Montagu, white, with two very short angular tentacula, usually edged with black, and with two black eyes at their base behind; the foot extending before the head, bifid.

The spire of the shell is sometimes eroded, and because the specimens which Mr. Jeffreys observed in this state were a little more ventricose, he has described them as a different species.

The foot is divided transversely very deeply, as in *Pedipes;* it is very slow in its motion in consequence of a double action of the foot being necessary to effect progression.

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## Fam. 5. LIMNÆADÆ.

Animal with an elongate foot, a more or less conical spiral body, a short muzzle, with dilated lips and compressed tentacles, with the eyes near the inner side of their base: the mantle, which covers the body, has a thin edge and is protected by a variably shaped pale uniform-coloured shell, which is clothed with a hard olive periostracum.

They live in ponds and ditches, often floating on the surface of the water, their back downwards, or crawling on the mud at the bottom, or on aquatic plants, but always coming to the surface to respire.

These animals were scattered about by the Linnæan conchologists among the *Helices*, the *Turbines*, the *Bullæ*, the *Nautili*, and the *Patellæ*, because their shells vary considerably in their shape and form; they form, however, a most natural group, from their having very similar animals. Like water-plants, they are distributed very widely, and are to be found in almost all parts of the world.

The following Table respecting the eggs of *Limnæadæ* is drawn up from M. Bouchard's observations, the first column giving the form of the masses of eggs, the second the number of eggs in each mass, the third the number of days after they are laid before they hatch.

| | 1. | 2. | 3. |
|---|---|---|---|
| Limnea auricularia | elliptical | 60—100 | 15—16 |
| ——— ovata | „ | 60— 80 | |
| ——— peregra | „ | 60— 80 | |
| ——— stagnalis | „ | 100—130 | |
| ——— palustris | cylindrical | 60— 80 | |
| ——— fossaria | rounded | 15— 20 | |
| Amphipeplea glutinosa | „ | 30— 40 | |
| Physa hypnorum | round or oval | 3— 12 | 16 |
| —— fontinalis | roundish | 3— 12 | 16 |
| Velletia lacustris | orbicular | 5— 12 | 24—26 |
| Planorbis contortus | „ | 6— 8 | 10—12 |
| ——— corneus | „ | 20— 40 | 16 |
| ——— albus | „ | 10— 13 | 12 |
| ——— imbricatus | „ | 3— 6 | 10—12 |
| ——— vortex | „ | 12 | 10—12 |
| ——— marginatus | „ | 6 | |
| ——— carinatus | „ | 6 | |
| ——— nitidus | „ | 4— 8 | 10—12 |

It had been supposed that the shells of fluviatile Mollusca could be distinguished from those of the terrestrial kind, by the edge of the mouth of the shell never being furnished with a thickened internal rib, and not being in the slightest degree reflexed, and that the animal never closes it with an *epiphragm;* however, further examination has shown that when the Pond-snails and the Whirl-shells are left nearly dry by the evaporation of the water,

either by the heat, or by dryness of the weather in winter, these animals assume the character of terrestrial Mollusca, thicken and reflect their mouth, and form an epiphragm to prevent themselves from being destroyed by the drying up of the fluid necessary for their respiration and life. Specimens in this state have been observed by Müller, Maton and Racket, Montagu, Michaud, and others, and have generally been considered as distinct species.

The family contains nine genera, which may be thus distinguished:—

*a.* Shell ovate, spiral; pillar with an oblique plait.

1. *Limnæus.* Shell rough; inner lip simple. (fig. 48.)
2. *Amphipeplea.* Shell polished, thin; inner lip expanded.

*b.* Shell conical, recurved; apex oblique.

3. *Ancylus.* Apex of the shell to the right. (fig. 52.)
4. *Velletia.* Apex of the shell to the left.

*c.* Shell ovate, sub-spiral; pillar smooth.

5. *Otina.*

*d.* Shell ovate, spiral; pillar simple.

6. *Physa.* Inner lip expanded.
7. *Aplexus.* Inner lip not expanded.

*e.* Shell discoidal.

8. *Planorbis.* Cavity of shell simple; mouth roundish or subquadrate.
9. *Segmentina.* Cavity of the shell divided by cross septa; mouth triangular.

* *Tentacles short, compressed, triangular, without any auricle at the base; jaws* 3, *smooth* (fig. 47.); *shell oblong, spiral.* (Limnæana.)

1. LIMNÆUS. (Mud Shell.)

Animal with a short broad foot, broad short compressed tentacles, without any auricles at the base, a large upper and two small rudimentary lateral jaws (fig. 47.), a large central spiral body,

Fig. 47. The jaws of *Limnæus auricularius* magnified.

*a*. Upper jaw; *b*. Rudimentary lateral jaws.

and a simple-edged mantle, covered by an external ovate, thin, dextral, transparent spiral shell with an ovate mouth, having a single oblique plait on the middle of the column running into the axis (fig. 48.).

*Limnæus* has a small central tooth, as it were squeezed up between two very large lateral ones, each primary lateral having a very large apex internally, with a small external one, while at the edge they have altered to one thick prolonged apex projecting inwards and irregularly lobed on its upper edge.

This genus is known from *Amphipeplea* and *Physa* by the edge of the mantle not being produced so as to cover the shell, and by the inner lip not being extended over the body whorl of the shell. It is known from *Aplexus* by the shell being dextral, and having the pillar-plait; the latter character, and their greater solidity, will distinguish even the reversed monstrosities of these shells from that genus.

*Fig.* 48.

*Limnæus pereger.*

The apex of the shell is often eroded or truncated (fig. 49); that is to say, as the upper part of the body is withdrawn from the tip, and the body moves forwards into the larger part of the shell, it forms a septum behind, and the part that is thus separated eventually falls off. Mr. Jeffreys, not being conversant with the physiology of the Mollusca, gives a curious explanation of this phenomenon, which is not uncommon in the terrestrial and marine, as well as fresh-water Mollusca. "In the absence of other nourishment, they (the *Limnæi*) will even devour each other, piercing the shell near its apex, and eating away the upper folds of the inhabitants. This accounts (he proceeds) for the mutilated and often imperfectly repaired state of the upper volutions of some specimens." (*Linn. Trans.* xvi. 371. But see *Turton**, *Man.* ed. 1. 78.; *Gray*, *Phil. Trans.* 1833.)

*Fig.* 49.

*L. palustris.*

* Dr. Turton, by mistake, appears to think that the shells have "a vascular connection" with the animal. This is not

In the spring, these animals are often infested with a small slender species of *Gordius*, which affix themselves to the edge of the mantle over the back of the neck; they are so common that Draparnaud mistook them for the respiratory organs of the animal. Montagu has also observed them on *L. truncatulus*.

The *Limnæi* principally feed on the slimy matter which covers sticks, shells, and stones, beneath the water and on the mud, which is constantly found in the intestines. (*Haldemann.*)

a. *Shell subovate, last whorl ventricose; mouth more than half the length of the shell.* (Radix *Montfort.* Gulnaria *Leach.*)

90. 1. LIMNÆUS *auricularius.* Wide-mouthed Mud Shell.—Shell extremely inflated, striolate, with a very short acute spire; aperture oblique, vastly expanded and roundish-oval. (t. 9. f. 100.)

Helix auricularia. *Linn. S. N.* i. 1250.; *Penn. B. Z.* iv. 86. f. 138.; *Mont.* p. 375. t. 16. f. 2.—Buccinum auricula. *Müller, Verm.* ii. 126.; *Sturm, Fauna*, vi. 12.—Lymnæa auricularia. *Flem. E. Ency.* vii. 77.; *Lamarck, Hist.* vi. ii. p. 161.—Lymneus auricularius. *Brard*, p. 140. t. 5. f. 2, 3.; *Turton, Man.* ed. 1. 117. f. 100.—Limneus auricularius. *Drap. Hist.* p. 49. t. 2. f. 28, 29. 32.; *Jeffreys, Linn. Trans.* xvi. 372.; *Rossm. Icon.* i. 98. t. 2. f. 55.; *Forbes and Hanley, B. M.* iv. 169. t. 123. f. 1, 2.—Bulimus auricularius. *Brug. E. M.* i. 304.—Radix auriculatus. *De Montfort.* ii. p. 207.

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the case; but still the description he gives of how the apex falls off is true; and Müller is correct in saying the apex of the shell was once perfect.

— Gulnaria auricularia. *Leach*, *Mollusc.* p. 148.; *Hartm. Gaster.* t. 16. — Turbo patulus. *Da Costa*, *B. C.* 95. t. 5. f. 17.

Younger: Lymneus acutus. *Jeffreys*, *Trans. Linn. Soc.* xvi. 373. — Lymnæus pereger, var. acuta. *Gray*, *Man.* t. 11. f. 101. d. — Limnea canalis. *Dupuy*, *Moll. Franc.* 482. t. 22. f. 2. — Limneus acronicus. *Studer.* — L. ampullaceus. *Ross. Icon.* f. 124. — Gulnaria ampla. *Hartm. Gast.* t. 5. — Limneus Hartmanni. *Studer.* — Gulnaria Hartmanni. *Hartm. Gast.* t. 7. — Gulnaria Monnardii. *Hartm. Gast.* t. 6.

In stagnant and slow waters.

Animal dull greenish yellow; tentacles speckled with brighter spots. (*Sturm*, t. 38.)

Shell an inch long, and three quarters wide, thin, brittle, transparent, of a light yellow horn-colour, more or less distinctly striate longitudinally; spire composed of four volutions, the three terminal ones very small; aperture very large, somewhat oval, with the outer lip expanded; pillar with a strong fold, the lip reflected and forming a slight hollow behind it.

The eggs are scarcely different from those of *L. stagnalis.* (See *Pfeiffer*, t. 7. f. 8.)

91. 2. LIMNÆUS *pereger.* Puddle Mud Shell.—Shell ventricose, more or less striate, with a moderately short acute spire. (p. 419. f. 6, 7. t. 9. f. 101.)

Buccinum peregrum. *Müller*, *Verm.* ii. 130. — Bulimus pereger. *Brug. E. M.* 301. — Helix peregra. *Gmelin*, *Syst. Nat.* 3659; *Mont.* p. 373. t. 16. f. 2. — Helix putris. *Penn. B. Z.* iv. f. 137.; *Turt. Dict.* p. 67. — Lymnæa putris. *Flem. Ed. Ency.* vii. 77. — Limneus pereger. *Drap.* p. 50. t. 2. f. 34. 37.; *Jeffreys*, *Linn. Trans.* xvi. 374.; *Turton*, *Man.* ed. 1. 118. f. 101.; *Forbes and Hanley*, *B. M.* iv. 165. t. 123. f. 3—7. — Lymnæa peregra. *Lamarck*, vi. ii. p. 161. — Gulnaria peregra. *Leach*, *Syn. Moll.* 106. t. 2. f. 4, 5. —

Lymnæus vulgaris. *Pfeiffer*, i. 89. t. 4. f. 22.; *Rossm. Icon.* i. 97. f. 53. (not *Jeffreys.*) — Limnæus opacus; L. fuliginosus; L. callosus; L. consobrinus; L. nitidus; L. corneus; L. solennis. *Ziegler.* — Buccinum rivale. *Studer.* — Limnæa limosa, and peregra. *Moq. Tand. M. F.* ii. 465. 467. t. 34. f. 11—16. — Limnæus vulgaris. *Pfeiffer, Deut. Moll.* i. 89. t. 4. f. 22.—Limneus fontinalis. *Studer*, 93.—Limnea intermedia. *Férus.*—Limnæa Borssii. *Dupuy, Moll. Franc.* 479. t. 25. f. 9. — L. thermalis. *Boub. Bull.* 1833, 28.— Limnæa Nouletiana, and Frencaleonis. *Gass.* f. 1, 2.— Limnæa glacialis. *Dupuy, Cat.* n. 199.—Turbo trianfractus. *Da Costa, B. C.* t. 5. f. 13. — Helix inflata. *Gmelin, S. N.* 3666. — Helix teres. *Gmelin, S. N.* 3667. — Helix siculus. *Dillw. R. S.* ii. 270. — Helix auricularia β. *Maton and Racket, Linn. Trans.* viii. 221. — Bulimus siculus. *Brug. E. M.* i. 385. — Helix auricula junior. *Dillw. R. S.* ii. 970. — Lymnea intermedia. *Lam. H.* viii. 414.; *Deless. Rec.* t. 30. f. 7.

Var. 1., subovate, aperture more dilated, spire acute (t. 11. f. 101. a.): Helix limosa. *Mont. T. P.* p. 381. t. 16. f. 1.— Limneus ovatus. *Drap.* p. 50. t. 2. f. 30, 31. — Lymneus ovatus. *Brard*, p. 142. t. 5. f. 4, 5. — Lymnæa ovata. *Lamarck*, vi. ii. p. 161.; *Kenyon, Mag. Nat. Hist.* ii. 425. f. g.— Lymnæus ovatus. *Rossm. Icon.* i. 100. t. 2. f. 56.—Bulimus limosus. *Poiret, Prod.* 39. — Limnea limosa. *Flem. B. A.* 274.

Var. 2., shell thick, regularly concentrically grooved: Gulnaria lacustris. *Leach, Syn. Moll.* 107.

Lakes, Westmoreland and Cumberland. (*General Bingham*, 1817.)

Var. 3., the shell thicker, and the outer lip not attenuated, spire scarcely exserted (t. 11. f. b.): Helix lutea. *Mont.* p. 380. t. 16. f. 6.; *Trans. Linn. Soc.* viii. 222., xiv. 169.— Lymnæa lutea. *Flem. E. Ency.* vii. 77.

Var. 4., shell moderate, spire very short, eroded, often concentrically grooved (t. 11. f. 101. c.): Gulnaria lacustris. *Leach, Mollusc.* p. 146. — Lymnea lacustris. *Brown, Brit. Shells*, t. 42. f. 24, 25.(?); *Potiez and Michaud, Gall. Moll.* i. 210. t. 22. f. 11, 12.; *Forbes and Hanley, B. M.* iv. 173. t. 132. f. 10. — Amphipeplea lacustris. *Brown, Ill. Conch. G. B.* 30.

Inhab. lakes, Scotland and Cumberland.

Var. 5. (Burnetti), ampullaceous, wrinkled, mouth very large, spire very short, scarcely raised: Limnæa Burnetti. *Alder*,

*Ann. and Mag. Nat. Hist.* ii. 396. t. 11. fig. upper (1846); *Forbes and Hanley, B. M.* iv. 172. t. 123. f. 8, 9.
Inhab. lakes, Scotland and Wales.

Monstrosity 1., with the outer lip thickened, with an internal rib, and expanded (*Maton, Linn. Trans.* viii. 218. t. 5. f. 8.*; *Montag. Supp.* 129.): Lymnea marginata. *Michaud, Compl.* 88. t. 16. f. 15, 16.

Monstrosity 2., spire reversed: Limnea lineata. *Bean, Mag. Nat. Hist.* vii. 493. f. 62. Lymnea marginata. *Michaud, Compl.* 88. t. 16. f. 15, 16.
Inhab. Scarborough.

Inhab. ponds and ditches.

Animal olive, yellow-spotted. (*Sturm,* t. 39.)

*Fig.* 50.

*L. peregeг.*

Shell varying much in size, of a greyish or yellowish colour, more or less concentrically striated; spire moderately elongated, about a third part the length of the whole shell, with the lesser volutions not so abruptly disproportionate to the body one as in the former; aperture oval-oblong, with the umbilicus sometimes obliterated. (fig. 50.)

The shells are often covered with a calcareous fur or deposit, which nearly hides them, and which has been sometimes mistaken for periostraca.

All the varieties run so much into each other, that they can hardly be considered as specifically distinct.

Mr. Jeffreys says, "I have no hesitation in referring the *Helix lutea* of Montagu to a variety of this species, having found it, both in a living state and thrown up together with other varieties, on the seashore near Swansea, within the influx of the Britton Ferry river." Nilson describes one species as living in brackish water in Sweden. The varieties of the

shell are in some situations often found reversed, as is the case with the variety recorded by Mr. Bean at Scarborough. It is not uncommon to find some specimens, the spires of which are more or less unrolled, or separated from each other. Indeed, this distortion appears to be more common in this shell than any other British species I am acquainted with.

Rossmässler (*Icon.* i. 98.) thinks that Dr. Turton's figure (f. 101.) represents what he considers a species under the name of *Limnæus vulgaris*, which is not the *L. vulgaris* of Jeffreys.

Mr. Jeffreys says, "The young shells of *L. acutus* are of a more elongated form than those of either *L. auricularius* or *L. pereger*. It has a more oblique and less ampullaceous form, and is of a thicker consistency than *L. auricularius*." Mr. Alder regards this variety as intermediate between *L. pereger* and *L. auricularius*, and says that, if it is not a distinct species, it may lead us to unite them all into one. It comes very near *L. lineatus* of Mr. Bean. The single specimen we have in the British Museum, from Mr. Alder, leads me here to consider it only a variety of *L. pereger*, as it much resembles a common London variety of that shell; and I still think *L. auricularius* is a species.

The *Gulnaria lacustris* of Leach is very peculiar, from the erosion of its tips, probably arising from its locality, the lakes of Cumberland. We have very similar, but rather darker and thicker shells, with tips perfect, from Lough Neagh, Ireland.

The latter variety may prove a distinct species,

when we shall have received more specimens and are able to observe the animal.

92. 3. LIMNÆUS *stagnalis*. Lake Mud Shell. — Shell oval, subulate, pointed, brittle; spire acute; whorls five; lower volution much inflated, and somewhat angular; the suture deep. (t. 9. f. 104.)

Limneus stagnalis. *Drap.* p. 51. t. 2. f. 38, 39.; *Alder*, *Cat.* 114.; *Turton*, *Man.* ed. 1. 121. f. 104. — Lymneus stagnalis. *Brard*, p. 133. t. 5. f. 1. — Lymneus stagnalis. *De Montfort*, ii. p. 268. Limnea stagnalis. *Flem. B. A.* 273.; *Sowerby*, *Gen.* f. 1. — Lymnæa stagnalis. *Lamarck*, *Syst.* 91., *Hist.* vi. ii. p. 159.; *Fleming*, *E. Ency.* vii. 77. — Stagnicola vulgaris. *Leach*, *Syn. Moll.* 105.; *Hartm. Gaster.* t. 8. 12. — Helix stagnalis. *Linn. S. N.* i. 1249.; *Mont.* p. 367. t. 16. f. 8. — ? Buccinum stagnale. *Müller*, *Verm.* 327. — Bulimus stagnalis. *Brug. E. M.* 303. — Lymneus major. *Jeffreys*, *Linn. Trans.* xvi. 375. — Limnæus stagnalis. *Rossm. Icon.* i. 95. t. 2. f. 49.; *Forbes and Hanley*, *B. M.* iv. 274. t. 124. f. 4, 5.—Lymneus lacustris. *Studer.* — L. bicolor. *Muhlf.* — L. appressa. *Jay*, — Turbo stagnalis. *Da Costa*, *B. C.* 93. t. 5. f. 11.

Var. 1., thinner, whorls rather more oblique and less ventricose (t. 9. f. 105.): Stagnicola elegans. *Leach*, *Syn. Moll.* 104.; *Schroet. Fluss. Conch.* t. 7. f. 6. ? — Helix fragilis. *Linn. S. N.* 1249. ?; *Mont. T. B.* 369. t. 16. f. 7. — Lymnæa fragilis. *Flem. E. Ency.* vii. 77.—Limneus fragilis. *Turton*, *Man.* ed. 1. 121. f. 105.

Var. 2., thicker, with a purple throat: Buccinum roseolabiatum. *Wolf*, in *Sturm*, *Fauna*, t. 36, 37.

In stagnant, and var. 1. slow running, waters.

Animal yellowish, paler beneath. (*Sturm*, t. 34. and 35.)

Shell an inch and a half long, and nearly an inch wide, thin and brittle, of a greyish white colour, often covered with an extraneous coat; spire composed of six or seven volutions, which are rounded and tumid, tapering to a fine point; the larger one striate longi-

tudinally, and generally crossed by raised transverse lines, giving it an angular appearance like cut glass; pillar with the fold very strong, forming a slight umbilicus, the lip white and spread.

These shells vary greatly in thickness, according to the nature of the water they inhabit. The outer whorl of the adult shell is often very gibbous. These variations have caused the animal, when found in clear quiet water, to be considered as a separate species.

Dr. Turton's figure (*Man.* ed. 1. f. 102.) of *Physa scaturiginum* has been suspected to represent a young individual of this species. It is a copy of Draparnaud's, which is a very doubtful species; and thought to be the young of some land shell. A reversed distortion is sometimes found. (*Hanow Seltenheiten*, ii. t. 1. f. 5.)

Montagu erroneously thought that these animals were unisexual; for he observes, the sexes, too, are distinct, as is usual in aquatic *Limaces*.

The eggs are ovate, with a yellow spot; they are united together into elongated subcylindrical or oblong masses, attached to water-plants, &c. (See *Pfeiffer*, f. 13, 14, 15.)

Rossmässler has described a North American species, like the first variety, under the name of *L. speciosus*. (t. 2. f. 50.)

M. Prevost has remarked that the impregnation of these animals is only accomplished by the participation of three individuals; the middle one using the functions of both sexes, the two others that of the male and the female only. Sometimes the

outer individual impregnates another individual, so that the animals form a more or less long chain floating on the surface of the water.

In the Danube this species grows to four times the size of the usual English variety, but does not otherwise differ from it.

The teeth of *L. stagnalis* are figured by *Otto Goldfuss*, 48. t. 7. f. &c.

b. *Shell subconical or elongate; whorls gradually enlarging; mouth generally shorter than the spire.* (Stagnicola *Leach.*)

93. 4. LIMNÆUS *palustris.* Marsh Mud Shell. — Shell conic-oval, with six rather tumid volutions, the lower one somewhat angular by raised transverse and longitudinal striæ; mouth ovate; throat brown or violet. (t. 9. f. 107.)

Buccinum palustre. *Müller, Verm.* ii. 131. — Helix palustris. *Gmelin*, 3658.; *Mont.* p. 373. t. 16. f. 10. — Helix stagnalis, var. *β*. *Penn. B. Z.* 86. t. 13. f. 136. n. — Helix limosa. *Linn. S. N.* i. 1249.? — Helix fragilis. *Pulteney, Dorset.* 48.; *Donov. B. S.* v. t. 175. f. 1.—Helix fontinalis. *Donov. B. S.* vi. 175. f. 2. and *. — Helix Corvus. *Gmelin, S. N.* 3665. —Helix striolata. *Oliv. Adriat.* — Limnea Corvus. *Dupuy, Cat.*—L. obscurus; L. limbatus; L. lamnosus. *Ziegl.* — L. fuscus. *Pfeiff. Deut. Moll.* 92. t. 4. f. 25. — L. vogesiaca, and L. disjuncta. *Put. Moll. Vog.* 58. — Limneus palustris. *Drap.* p. 52. t. 2. f. 40—42., and t. 3. f. 1, 2.; *Alder, Cat.* 114.; *Turton, Man.* ed. 1. 123. f. 107. — Limnæus palustris. *Rossm. Icon.* i. 96. f. 51, 52.; *Forbes and Hanley, B. M.* iv. 180. t. 124. f. 2. — Lymneus palustris. *Brard*, p. 136. t. 5. f. 6, 7. — Lymnæa palustris. *Fleming, Ency. Edinb.* vii. 77.; *Lamarck*, vi. ii. p. 160. — Stagnicola communis. *Leach, Syn. Moll.* 103. — Limnea palustris. *Flem. B. A.* 274. — Bulimus palustris. *Brug. E. Méth.* 302. — Lymnea fragilis. *Kenyon, Mag. N. Hist.* ii. 425. f. 182. e. 1829. — Limneus communis.

"*Leach*;" *Jeffreys, Linn. Trans.* xvi. 276.—Limneus tinctus. *Jeffreys*, l. c. 378—392.

Var. 1., apex decollated. *Mag. N. Hist.* vii. 161. f. 32.; *Linn. Trans.* viii. t. 5. f. 8. (See fig. 49 p. 200.)

In marshes and ponds.

Animal yellow-brown or cinereous, speckled with lighter colour.

Shell three quarters of an inch long, brown horn-colour, rather opaque, suddenly sloping in a conic manner, the volutions hardly raised, slightly striate longitudinally, and crossed with more remote transverse ones, like the facets of cut glass; aperture oval, covering nearly half the shell, often chocolate-brown and glossy in the inside, sometimes rosy about the pillar, where the peristome is spread and glossy, forming a slight umbilicus.

*Fig.* 51.

*L. palustris.*

These shells vary very greatly in size; in their colour, from pale brown to dark violet brown, and especially the colour of the throat, which is rarely bright violet brown; in the thickness of the substance of the shell; and in the shape, occasioned by the different degrees of the ventricoseness of the whorls.

The smaller specimens often have their tips truncate. (See fig. 49.) Mr. Alder thinks that var. *β.* of Mr. Jeffreys, which is found in rivers, frequently in the tide-way, and never has the size of those found in ponds, is intermediate between *L. palustris* and *L. fossarius*. Probably the small size is produced by the current not allowing the animal its usual rest; we often regard a different habitation as

a proof of a difference in species, while it may be the cause of the variation.

The eggs are like those of *L. stagnalis.* (See *Pfeiffer*, t. 8. f. 18.)

These animals are extremely variable in size and colour, according to the locality in which they are found, and the abundance of their food.

Mr. Alder observes that a variety of a much smaller size is found on the margins of rivers, and another is found in mountain streams.

94. 5. LIMNÆUS *truncatulus.* Ditch Mud Shell. — Shell oblong-oval, pointed, brittle, perforated, with six or seven rounded and deeply divided volutions, striolate longitudinally and across; mouth ovate-oblong. (t. 9. f. 108.)

Helix fossaria. *Mont.* p. 372. t. 16. f. 9.; *Linn. Trans.* viii. t. 5. f. 9. — Buccinum truncatulum. *Müller, Verm.* ii. 130. — Helix truncatula. *Gmelin*, 3659.; *Dillw. R. S.* 967. — Limneus minutus. *Drap.* p. 53. t. 3. f. 5, 6.; *Alder, Cat.* 115. — Bulimus truncatus. *Brug. E. M.* i. 310. — Limneus fossarius. *Turton, Man.* ed. 1. 124. f. 108. — Lymneus minutus. *Brard*, p. 138. t. 5. f. 8, 9. — Lymnæa minuta. *Lamarck*, vi. ii. p. 162. — Stagnicola minuta. *Leach, Mollusc.* p. 143. — Lymnæa fossaria. *Flem. Edinb. Ency.* vii. 77., *B. A.* 274. — Limneus truncatulus. *Jeffreys, Linn. Trans.* xvi. 377. — Limnæus minutus. *Rossm. Icon.* i. 100. t. 2. f. 57. — Bulimus obscurus. *Pioret, Prod.* 35. — Limnophysa minuta. *Fitz.* 113. — Limnæus truncatulus. *Forbes and Hanley, B. M.* iv. 177. t. 124. f. 3. — Lymnea minuta. *Schub. and Wagner*, f. 4. t. 34, 35. — Limnæus limosus. *Cantr. Mém. Brux.* 1836, 157. — Limnea minuta. *Grass. Moll. Franc.* t. 4. f. 44. — Limnæa truncatula. *Alder, Moll.* 42. — Lymnea oblonga. — *Pat. Moll. Vog.* 60. — Limnea microstoma. *Drouet.* — Limnea Doublieri. *Req.*

Var. 1., conic-oval, less glossy brown and smooth. *Drap.* p. 53. t. 3. f. 7.

Monstrosity with the lower volution flattened at top, in the centre of which are sunk the other volutions.

In marshes and ditches, on the mud.

Animal greyish or dusky.

Shell half an inch long, pale brown or greyish, and is readily distinguished from the last by the rounded and deeply divided volutions; aperture nearly half as long as the shell, the outer lip a little reflected, but not spread nor glossy.

95. 6. LIMNÆUS *glaber*. Eight-whorled Mud Shell. — Shell elongated, oblong-cylindrical, tapering, brittle, pellucid, yellowish white, with seven or eight convex volutions, and the aperture elongate-ovate. (t. 9. f. 106.)

Helix octona. *Penn. B. Z.* ii. t. 86. f. 135. — Helix octanfracta. *Mont.* p. 396. 588. t. 11. f. 8. — Limneus elongatus. *Drap.* p. 52. t. 3. f. 3, 4. (bad); *Alder*, l. c. 115.; *Turton*, *Man.* ed. 1. 122. f. 106. — Limnea elongata. *Sowerby*, *Gen.* f. 6. — Limnæus elongatus. *Rossm. Icon.* i. 101. t. 2. f. 58. — Stagnicola octanfracta. *Leach*, *Syn. Moll.* 102. — Helix peregrina. *Dillwyn*, p. 954. — Buccinum glabrum. *Müller*, *Verm.* ii. 135. (?) — Lymnea elongata. *Flem. E. Ency.* vii. 78. — Limnea octona. *Flem. B. A.* 274. — Limneus glaber. *Gray. Man.* 243. t. 9. f. 106.; *Forbes and Hanley*, *B. M.* iv. 178. t. 124. f. 1. — Lymnea elongata. *Nilson*, *Moll.* 7. — Limneus subulatus. *Kickx*, *Syn.* 60. f. 13, 14. — Limnæa variabilis. *Mill. Moll. Main.* 51. — Omphiscola glabra. *Beck*, *Ind.* 310. — Leptolymnea elongata. *Swains. Moll.* 338. — Limnæa glabra. *Moq. Tand. M. F.* ii. 478. t. 34. f. 36, 37.

Monstrosity, the outer lip with a thick white internal rib: Lymnæa leucostoma. *Lamarck*, vi. ii. p. 162. — Bulimus leucostoma. *Poiret*, *Prod.* 37.

Var. 1., spire elongate, twisted.

Var. 2., apex of spire truncated or decollated.

In stagnant waters.

Animal blackish or dusky.

Shell an inch long, regularly tapering, with the ultimate volution not larger in proportion than the rest; spire composed of seven or eight tumid volu-

tions, on the larger of which are often a few transverse striæ, and all of them obscurely striate longitudinally; aperture narrow oval, not a third part as long as the spire, with the pillar spread and white, but not forming an umbilicus.

It varies in the convexity of the volutions, and their number, as we have them from different waters with from six to nine.

This animal, like the other species, but perhaps more frequently, forms a thick white internal rib to the outer lip, just within the edge.

2. AMPHIPEPLEA *Nilson.* (Membrane Shell.)

The animal very like *Limnæus;* but the edge of the mantle is much extended, so as to cover (when the animal is expanded) the oval, very thin, nearly membranaceous, flexible shell, which, like *Limnæus,* has a plait on the pillar lip; its axis and part of the body whorl is covered with an expansion of the inner lip.

In *Amphipeplea* the same arrangement of teeth prevails; but the tubercle of the lateral teeth is even still larger, in proportion to its plate.

Müller, Montagu, and Nilson give a good description of this animal. Draparnaud considered the part of the mantle which is reflected over the shell to be a viscid coat.

Captain Brown, apparently not aware of the prior name, has called this genus *Lutea,* a name that is quite inadmissible.

96. 1. AMPHIPEPLEA *glutinosa.* Glutinous Membrane Shell. — Shell semiglobular, extremely

thin and inflated, amber-coloured; spire with three scarcely produced volutions. (t. 9. f. 103.)

Buccinum glutinosum. *Müller*, *Verm.* ii. 129.—Helix glutinosa. *Gmelin*, *S. N.* 3659.; *Mont.* p. 379. t. 16. f. 5.—Bulimus glutinosus. *Brug. E. M.* 306.—Limneus glutinosus. *Drap.* p. 50.; *Turton*, *Man.* ed. 1. 120. f. 103.; *Jeffreys*, *Linn. Trans.* xvi.; *Michaud*, t. 16. f. 13, 14.—Limnæus glutinosus. *Forbes and Hanley*, *B. M.* iv. 182. t. 124. f. 6, 7.—Limnea glutinosa. *Gray*, in *Sowerby*, *Gen.* f. 5.; *Flem. B. A.* 275.—Myxas Mulleri. *Leach*, *Syn. Moll.* 108.—Amphipeplea glutinosa. *Nilson*, *Moll. Suec.* 58.; *Rossm. Icon.* i. 93. t. 2. f. 48.

In stagnant ditches, England, North Wales, Ireland. Locally and periodically abundant; living on the roots of duck-meat.

Montagu described the animal as large in proportion to its shell, like many of the *Bullæ;* and he thinks it might be placed in that genus. It is covered with a tenacious slime, and is of a pale dull yellow colour, sprinkled with bright brimstone spots; the tentacles are very broad at the base, and flat; eyes small, placed at the base of the tentacula on the inside; front broad; the foot spread and moderately long: when the membrane that usually covers the shell is withdrawn, the colour of the animal beneath the transparent shell gives it an appearance of highly polished tortoise-shell. In the young shell the mantle is more developed, and almost entirely covers the shell.

Shell about half an inch in diameter, extremely thin and transparent, of an amber or yellowish horn-colour, somewhat orbicular, with the outer lip much expanded; spire consisting of three and a half volutions; the smaller one lying nearly flat on the larger

one, marked by a deep suture, and ending obtusely; the larger volution regularly striate; pillar without umbilicus.

This shell appears to have a very extended range, being found in Sweden in the north, and Syria in the south.

97. 2. Amphipeplea *involuta*. Involuted Membrane Shell.—Shell ovate, subglobose, truncated, thin, transparent, very brittle; spire flat, of three or four very gradually enlarging whorls. (t. 12. f. 147.)

Limneus involutus. *Harvey; Thompson, Linn. Trans.* 1834; *Alder, Cat.* ii. 215.; *Thompson and Goodsir, Ann. N. H.* v. 22. — Limnæus involutus. *Forbes and Hanley, B. A.* iv. 184. t. 122. f. 11. — Amphipeplea involuta. *Gray, Man.* 245. t. 12. f. 147. — Limnæa involuta. *Brown, Ill.* t. 18. f. 5.

Inhab. lakes, Ireland.

Shell very thin, and polished like the former, but is easily distinguished from it by its more ovate shape and truncated tip, produced by the flat or sometimes slightly concave form of the spire. It is easily known from *Physa fontinalis*, which it greatly resembles, in not being reversed, by the peculiar form of the spire, and the plait on the pillar lip.

Professor Forbes thinks that this shell may be some monstrous yet permanent variation of a mere ordinary *Limnæus*. (See *Brit. Moll.* 185.)

On my writing to Mr. Thompson, of Belfast, respecting this shell, he has kindly furnished me with the following particulars, which I print entire:—

"Limneus involutus. *Harvey MSS.*—Spire sunk within the outer whorl; aperture very large, extending to the apex.

"A few specimens of this beautiful shell were collected by my friend William Henry Harvey, Esq., of Limerick, in a small alpine lake on Cromaglaun Mountain, Killarney, in the month of April, 1832; and believing them to be of a new species, were by their discoverer designated by the above name.

"Of three specimens sent to Belfast by Mr. Harvey, and contained in my own cabinet and in those of Dr. Drummond and Mr. Hyndman, the largest is $5\frac{1}{2}$ lines in length and $3\frac{1}{2}$ in breadth; volutions four, the largest enveloping the other three, none of which are visible in the profile of the shell; aperture very large, wide at the base (showing the columella throughout its entire length), and extending to the apex; margin reflected only where it joins the pillar.

"Shell polished, extremely thin, of a pale amber colour, with coarse longitudinal striæ. It approaches *L. glutinosus* more nearly than any other species; but in consequence of the aperture extending to the apex, has, at a cursory view, a greater resemblance to *Bulla akera* than to any other British shell, their similarity being rendered still more striking by the columella having the same appearance in both species."

*Amphipeplea luzonica*, which has the greater part of the shell covered with the mantle, even in the animals preserved in spirits, much resembles this species.

** *Tentacles compressed, triangular, with an auricle at the base; jaws three, papilliform* (fig. 53.): *the eyes are placed on a small lateral lobe on the side of the base of the triangular truncated tentacle; shell conical, hoodlike, apex subspiral.* (Ancylina.)

### 3. Ancylus. (River Limpet.)

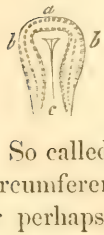
Animal conical; body attached to the foot the whole length, and covered with an ovate, conical, simple shell, which is bent to the right, with a central posterior rather obliquely recurved tip; the cavity with a lunate submarginal scar, interrupted on the left side, for the passage of the air-tube to the lungs. The aperture of respiration and vent are on the left side. (fig. 52.)

*Fig.* 52.

*Ancylus fluviatilis.*

On the tongue of *Ancylus* there are thirty similar lateral teeth in a straight line on each side of the central tooth; and then there is a curve through a series of six more teeth, where a trifling change in their form occurs.

*Fig.* 53.




The Jaws of *Ancylus fluviatilis* magnified.

*a*, Upper jaw; *b*, Lateral jaws united; *c*, The mouth closed.

So called from the close connection by which the circumference of the shell is fixed to its attachment; or perhaps from the conical point, resembling the

handle of a cover; in which case it should be written *Ansulus* or *Ansylus*.

The shell differs from *Siphonaria* (with which alone it can be confounded, on account of the peculiar form of the muscular scar, and the lateral situation of the apex,) in being thin and pellucid, only finely striated, and covered with a thin olive periostracum.

It only agrees with *Patella* in the outward appearance of the shell; for in that genus the apex is anterior, and in this it is posterior, as in most Univalves.

This animal has been moved from one family, and even order, to another, as naturalists have settled among themselves whether it breathed by gills or lungs. Rang places it with the *Pleurobranchi*, and observes that it lives on stones and aquatic plants, but that he never observed it to breathe free air. Mr. Guilding (*Zool. Journ.* iii. 335.) and Treviranus (*Journal Phys.* 1832, t. 17.), who published a detailed dissection of the genus, mistake the valve which closes the opening of the breathing cavity, for a gill. The head is quite destitute of the labial appendages noticed by Rang.

Mr. Berkeley (and my own observations bear out his accuracy) observes that the animal is undoubtedly one of the *Limnæidæ*, and nearly allied to *Physa*. The pulmonary cavity, like that of *Physa*, is on the left side, with a valvular margin, in one corner of which is situated the rectum; between this and the foot is the orifice of the matrix. They are hermaphrodite, and may be observed in connection, as was observed by Lister (*Anim. Ang.*), about the end of September; and, as the latter author affirms, they fix

their spawn on stones in small gelatinous globules, each containing many small eggs. (*Pfeiffer*, t. 161. f. 21.) They have a retractile (and not exserted, as described by Guilding) male organ at the base of the left tentacle.

These animals sometimes swim about on the surface of the water, like *Limnæi*, with the back downwards. In fact they are *Limnæi*, with very short conical, instead of long spiral bodies.

Mr. Jeffreys doubts their being Pneumonobranchous; and Dr. Fleming in one of his works refers them to the genus *Crepidula!* and in his *British Animals* to the *Pulmonifera*. The tongue is a broad spiral band twisted at the end, longitudinally keeled, and set with numerous close cross-bands of minute, close-set, equal, short triangular spines directed backwards and furnished with a simple membranaceous margin on each side, half as broad as the tongue itself; the stomach very much resembles the gizzard of a fowl, has a strong muscular band on each side, and is nearly filled with small flinty particles.

The *Ancyli* prefer clear water, living attached to stones and the sunken stems of aquatic plants. They often ascend and attach themselves to damp rocks of waterfalls.

During the summer, when the waters are low, they secrete themselves in the mud and await the return of the water. The shell completely covers the animal; and when they walk, the end of the tentacles, and rarely the tip of the muzzle, appear beyond the edge of the shell. They feed principally on the radical fibres of water plants, small confervæ, and green

vegetable matters. They are timid, rarely change their places, walk very slowly, and do not swim. The eggs are ovoid, hyaline, four or eight, placed in a row in a horny, mucous, orbicular, depressed, transparent capsule attached to solid bodies.

Teeth (30, 1, 30) central, much compressed, apex with a single sharp point; lateral teeth bent and hooked, the first simple, the last contracted at the bend and denticulated. (Figured by *Otto Goldfuss*, 49. t. 7. f. n.; and *Weigmann, Arch.* 1836, t. 10. f. 9—11.)

It is no proof that the animals do not breathe free air because they are usually observed attached to stones, like *Patellæ*, at the bottom of the water; for *Limnæus pereger* is more frequently found at the bottom of the water on the mud than in any other place, and I have seen a specimen in exactly the same place for several days without moving. But the *Ancyli* are often found, as has been observed by Mr. Jeffreys, out of the water, and only within reach of the spray of a waterfall.

98. 1. ANCYLUS *fluviatilis*. Common River Limpet.—Shell conoid, with the point recurved and near one end; aperture roundish-oval, disk bluish.

Ancylus fluviatilis. *Müller, Verm.* ii. 201.; *Drap. Hist.* p. 48. t. 2. f. 23, 24.; *Brard*, p. 200. t. 7. f. 3.; *Sowerby, Gen.* fig. 1.; *Turton, Man.* ed. 1. t. 140. f. 125.; *Forbes and Hanley, B. M.* iv. 186. t. 122. f. 4.; *Clark, Ann. and Mag. N. H.* xv. 278.—Patella fluviatilis. *Lister; Da Costa, B. C.* i. t. 2. f. 8.; *Mont.* p. 482.—Patella lacustris. *Linn. S. N.* 1260.; *Turt. Dict.* p. 138.—Crepidula lacustris. *Fleming, Ency.*—Ancylus simplex; A. Janii; A. gibbosus; A. cyclo-

stoma; A. meridionalis; A. costatus; A. albus; A. striatus; A. Tinei; and A. Fabrei. *Bourg.* in *Jour. Conch.* 1853, 187.—A. riparius. *Desm. Bull. Soc. Philom.* 1814, 19. t. 1. f. 2.—A. capuloides. *Jan*, in *Risso, Mal. Com.* 37. t. 1. f. 7.—A. deperditus. *Dupuy, Hist. Moll.* 494. t. 26. f. 4.—A. vitraceus, and A. striatus. *Morelet, Moll. Port.* 87. t. 8. f. 3, 4.—Ancilus fluviatilis, and sinuosus. *Brard. Coq. Par.* 200. t. 7. f. 3, 4.—Ancylus sinuosus. *Gras, Moll. Franc.* t. 5. f. 8.—A. (Ancylastrum) fluviatilis. *Moq. Tand. Moll. Franc.* ii. 484. t. 35. f. 5—38. t. 36. f. 1—49.

Var. 1., with slight longitudinal striæ.

In streams and rivulets attached to stones.

Animal greyish.

Shell about a quarter of an inch in diameter, and nearly as much in height, semitransparent, light horn-colour, covered with a dusky green skin slightly marked with concentric striæ, inside bluish white, glossy; the crown slightly curved downwards.

The shells of these animals are modified in form and elevation according to the surface of the substance to which they may happen to be attached, as in the marine *Patellæ;* hence the Continental naturalists have made them into several species depending on the elevation of the cone of the shell, the more or less concave form of the different margins of the aperture, the acuteness or bluntness of the apex, and the strength of the radiating striæ.

### 4. Velletia. (Lake Limpet.)

The animal like *Ancylus*, but dextral; the shell oblong, compressed, conical, with the apex rather behind the middle, bent to the left, as in other dextral shells; mouth elongate; orifices of respiration, &c., on right side of mantle.

In *Velletia* no part of the cross row of teeth is straight; its central part is much arched, and is composed of the central tooth and twelve lateral teeth on each side, which do not alter much in form; then comes one tooth of a different form, and lastly six more on each side, which latter are in a slight curve.

99. 1. VELLETIA *lacustris*. Oblong Lake Limpet. —Shell oblong, compressed, with the point slightly recurved in an oblique direction and nearly central. (t. 10. f. 126.)

Ancylus lacustris. *Müller, Verm.* ii. 199.; *Drap.* p. 47. t. 2. f. 25—27.; *Sowerby, Gen.* f. 2.; *Turton, Man.* ed. 1. 141. f. 126. — Patella lacustris. *Montagu, T. B.* p. 484.; *Don. B. S.* t. 150. (not *Linn.*) — Patella oblonga. *Lightfoot, Phil. Trans.* lxxvi. (1786), 168. t. 2. f. 1. 5.; *Turt. Dict.* p. 138. — Crepidula oblonga. *Fleming, Ency.* — Ancylus oblongus. *Forbes and Hanley, B. M.* iv. 188. t. 122. f. 5.; *Clark, Ann. and Mag. N. H.* xv. 278. — Patella cornea. *Poiret, Prod.* — Velletia lacustris. *Gray, Man.* 251. t. 10. f. 126. — Acroloxus lacustris. *Beck, Ind.* 124. — Ancylus Moquinianus. *Bourg. Jour. Conch.* 1853, 197. t. 6. f. 9.

In still waters, attached to aquatic plants.

Animal blackish.

Shell a quarter of an inch long, and hardly a tenth in breadth, extremely thin and transparent, smooth, oblong, compressed at the sides, with the apex pointed and near the centre of the shell, inclining towards the narrower end, and turning a little obliquely towards the left side.*

The egg cases are very depressed, orbicular or

* Mr. Guilding (*Zool. Journ.* iii. 535.) has described two West Indian species of this genus, which I have lately had the opportunity of reexamining and proving to be true *Velletiæ*, which was doubtful from Mr. Guilding's erroneous description of the animal.

subovate, attached to dead leaves, each containing four to twelve ovoid eggs. They are hatched at the end of twenty or twenty-one days.

Angenville (*Zoom.* t. 8. f. 11.) erroneously represents the head of the animal as appearing beyond the edge of the shell.

M. Michaud has described a specimen, which has a sinus on the front edge (most probably caused by the animal having lived on a stone which had a prominence), under the name of *Ancylus sinuosus.* (*Compl.* 90. t. 16. f. 1, 2.)

*A. sinuatus*, *A. Traysianus* Dupuy, and *A. bireflexus* Bourgegnart are distortions of a similar kind.

*** *Tentacles compressed, scarcely raised; eyes far back; jaws single* (?); *shell ovate, subspiral, marine.* (Otinina.)

### 5. Otina *Gray.*

Animal rather large for the size of the shell, white, very glutinous; head depressed; tentacles very short, broad, compressed, several raised; eyes large, sessile, rather close together on the nape; labial palpi large, nicked in the middle; foot rather large, produced and nicked in front, not extending behind; the shell behind divided in two parts by a transverse medial groove; mantle inclosed; the lingual membrane broad, oblong, rounded in front; teeth almost sixty in each cross row, and almost a hundred rows all similar, oblong-elongate, four-sided, close together; apex recurved, produced into a conical tooth; jaws

horny; operculum none; shell depressed, nearly ear-shaped; spire small, lateral; aperture large; peristome nearly continuous; pillar arched.

On the sea-coast, just above or just within the edge of the tide-line. The animals walk by the alternate motion of the two sections of the foot and of the lower surface of its large broad head.

This animal was first described as belonging to the genus *Helix*. Dr. Fleming referred it to *Velutina*; and after examining the animal, I separated it as a section of that genus under the name of *Otina*. Mr. Clark adopted it, and placed it, with some doubt, among the genera of *Auriculidæ*, which he considers pectinobranchous. Messrs. Forbes and Hanley refer it to *Pyramidelladæ*, describing the animal as having "an armed tongue and jaws, and branchial plume single." But in 1854 I showed that the animal, instead of having gills, respired free air in a closed branchial cavity, and had teeth like other *Pneumonobranchiata*, and compared it with *Auricula*. Dr. Pfeiffer forms for it a small sub-family of *Otininæ* in *Auriculidæ;* but the form of the animal, and especially of the tentacle and the shell, bears much more affinity to the family *Limnæadæ*.

100. 1. OTINA *otis*. — Shell depressed, semi-ovate, rather solid, very slightly striated, covered with a thin periostracum, rather shining brown, often eroded; spire minute; whorls $2\frac{1}{2}$, the last somewhat compressed; aperture nearly horizontal, ovate oblong; peristome nearly continuous, with the pillar edge liver-coloured.

Velutina otis. *Fleming*, *B. A.* 326. — Helix otis. *Turton*, *Conch. Dict.* 70.—Galericulum otis, and G. ovulum. *Brown*, *Ill. Conch.* — Otina otis. *Gray*, *B. Z. Soc.* 1848; *Clark*, *Ann. and Mag. N. H.* vi. 24.; *Forbes and Hanley*, *B. M.* iii. 321. t. 99. f. 2, 3.; *Pfeiffer*, *Moc. Aur.* 12.

Rocks on sea-coast. "These animals are generally found at the roots of *Lichina pygmæa* on the rocks, often in company with *Lasea rubra*. When they are placed in water, they generally make their way out and fix themselves to some dry spot, as is the case with many *Littorinæ*, which almost always constantly live in free air."—*Clark.*

**** *Tentacles elongate, linear; jaw single, angular* (fig. 54.); *body and shell ovate, spiral, sinistral.* (Physina.)

### 6. Physa. (Bubble Shell.)

The body spiral, on the middle of an elongate foot; the mantle large, lobed on the edge, and expanded over the ovate, thin, transparent, spiral, sinistral shell, which has an oblong mouth, with the inner lip expanded and spread over the body whorl, covering it and the smooth pillar; the tentacles have an auricle at the base.

*Fig.* 54.

*Physa fontinalis.*

The tongue has a multitude of teeth of a similar form, though different from any that I have seen in other genera; but the delicacy of the tongue

membrane is such that I have failed in ascertaining either the form of the central tooth, or the curve of the horizontal row.

101. 1. PHYSA *fontinalis*. Stream Bubble Shell.—Shell horn-colour, oval, with a very short obtuse spire; aperture dilated at the base. (t. 9. t. 11. f. 110.)

Bulla fontinalis. *Linn. Trans.* viii. 126. t. 4. f. 1. (not description); *Linn. S. N.* 1185.; *Mont.* p. 226. — Bulinus perla. *O. F. Müller, Naturforscher*, xv. 6. t. 1. — Planorbis bulla. *Müller, Verm.* ii. 167.—Bulimus fontinalis. *Brug. Ency. Méth.* 306. —Bulla fluviatilis. *Turton, Conch. Dict.* 27.—Helix bullæoides. *Donovan, B. S.* t. 168. f. 2.??; *Linn. Trans.* viii. p. 126. t. 4. f. 1.—Physa fontinalis. *Drap. Hist.* p. 54. t. 3. f. 8, 9.; *Brard*, p. 167. t. 7. f. 7, 8.; *Lamarck*, vi. ii. 156.; *Leach, Syn. Moll.* 100.; *Jeffreys, Linn. Trans.* xvi. 379.; *Turton, Man.* ed. 1. 127. f. 110.; *Forbes and Hanley, B. M.* iv. 140. t. 122. f. 8, 9. — Limnea fontinalis. *Gray*, in *Sowerby, Gen.* f. 8. — Turbo adversus. *Da Costa, B. C.* 96. t. 5. f. 6. — Physa (Bulinus) fontinalis. *Moq. Tand. Moll. F.* ii. 451. t. 32. f. 9—13.

Var. 1., spire longer (t. 11. f. 110*.); *Forbes and Hanley, B. M.* iv. 140. t. 122. f. 10: Physa acuta? *J. Sowerby* (not *Drap.*).

Var. 2., last whorl rather angular behind: Physa alba. *Jenyns, MSS.* (not *Turton*).

In rivers and streams, on aquatic plants.

Animal blackish grey; tentacles paler; the jaw triangular, lower edge arched, crenulated (fig. 55.);

*Fig.* 55.

The upper Jaws of *Physa acuta* magnified.
The narrow non-striated part is implanted in the flesh.

teeth lanceolate; strongly toothed on each side. See *Otto Goldfuss*, 48. t. 6. f. m., and *Weigman, Arch.*

1836, t. 9. f. 10, 11. They are very unlike the teeth of *Lymnea*.

Shell nearly half an inch long, and half as much broad, very thin and fragile; spire extremely short, of four volutions, the lower one much inflated, the others small and ending obtusely; aperture covering nearly the whole of the shell; pillar slightly sinuate and white, not reflected.

This shell varies considerably in shape. Mr. Jeffreys distinguished four varieties. Some have the spire elongated considerably more than the rest. Dr. Turton (*Conch. Dict.*) described a small subglobose specimen under the name of *Bulla fluviatilis;* but it probably is only a young specimen of the common state.

It is the young specimens of these shells alone which agree with the Linnæan and Lamarckian character of the species in the shortness of the spire; for as the shell increases in size, the whorls are gradually turned more obliquely down the axis, so that the older shells have a longer spire in proportion than the young ones.

There are nevertheless two very distinct varieties, which may prove to be distinct species, and indeed have been considered so by several of my friends, as Mr. Fryer and Mr. Hinks, who study these animals. The one which agrees best with Linnæus's and Lamarck's character of *Physa fontinalis* is generally a small shell of a clear yellow colour, with a very short rounded spire formed of $3\frac{1}{2}$ or 4 very gradually enlarging whorls, the suture of the last being more oblique than the rest, and with a subacute tip.

It is a young shell of this variety that was most probably figured by Donovan under the name of *Helix bullæoides* (*British Shells*, t. 168. f. 2.), and of *Bulla fluviatilis* by Dr. Turton, in his Dictionary, p. 27. It is a large specimen of this variety at fig. 110., and others with a rather longer spire, as if passing into the next variety, which are figured by Lister, t. 134., by Da Costa, t. 5. f. 6.

The second variety, which is perhaps *Physa subopaca* of Lamarck, is a larger shell, often reaching 3-8ths of an inch in length, which is most probably described by Montagu and Turton as the adult of the former variety; for they say it sometimes reaches half an inch long. It is easily known from the former by the spire being produced about 1-3rd the length of the mouth, and formed of four or five distinct convex whorls; and it has a blunt top. Indeed, by the figures of Moquin-Tandon (t. 33. f. 1. 16.), it is very doubtful if this variety may not be the *P. acuta* of Draparnaud.

This variety is called *Physa rivalis* by the Yorkshire conchologists, but is quite distinct from the West Indian *P. rivalis* described by Dr. Maton. It is figured in Dr. Maton and Racket's paper (*Linn. Trans.* xviii. t. 4. f. 1.) as *Bulla fontinalis*, but does not agree with his description of the species, which certainly belongs to the first variety. This figure does not represent the inner lip sufficiently spread on the body whorl. The difference in the bluntness of the spire between the two varieties at first made me much inclined to consider them as species; but the various specimens I have examined, and the

variation that I found in the specimen sent to me under the two names, induce me for the present to consider them as only variations of the same, probably produced by some local situation, as the difference in the depth of the water, or its being still or running. Mr. Hincks informs me, the first variety is always found in very small plashes of water, or in water among grass, while the larger one is found in canals and nearly still rivers, which may account for all the difference between them; for we have often been inclined to consider varieties as distinct, because they were found in different situations, *whereas the difference of situation may be the only cause of the variation*, which would probably disappear if they were placed and allowed to breed in similar circumstances to the other variety.

Mr. Jenyns informs me, that he has a British specimen which he thought was the *Physa alba* of Turton (which is undoubtedly a Sicilian species), differing from the general form of *Physa fontinalis* in the hinder part of the last whorl being rather angular, as in *Limnæus stagnalis.*

The eggs are similar to those of *Planorbis* and *Limnæus*, in groups forming oblong or rather depressed globular masses attached to the surface of leaves. (See *Pfeiffer*, t. 8. f. 1—8.; see also *Jeffreys*, *Linn. Trans.* xvi. 380.)

### 7. Aplexus *Fleming.* (Aplexus.)

Animal exactly like *Physa;* but the mantle edge is simple and not reflected over the shell, and the tentacles without any auricle at the base, the

shell is longer, and the inner lip parallel to the outer, and not spread over the body whorl.

Adanson first described this genus in 1757, under the name of *Bulin* (Bulinus), which ought to be adopted; but it would create confusion, as Hartmann and Mr. Broderip have lately changed Lamarck's genus *Bulimus*, which is synonymous with *Cochlea* of Adanson, into *Bulinus*.

102. 1. APLEXUS *hypnorum*. Slender Aplexus.—Shell horn-colour, oblong, with an elongate pointed spire; aperture oval-lanceolate. (t. 9. f. 113.)

Bulla hypnorum. *Linn. S. N.* i. 1182.; *Mont.* p. 228.—Bulimus hypnorum. *Brug. Ency. Méth.* 301.—Planorbis turritus. *Müller, Verm.* ii. 169.—Physa hypnorum. *Drap. Hist.* p. 55. t. 3. f. 12, 13.; *Turton, Man.* ed. 1. 129. f. 113.; *Forbes and Hanley, B. M.* iv. 143. t. 122. f. 6, 7.—Bulla rivalis. *Flem. Ed. Ency.* vii. 85.—Limnea turrita. *Gray*, in *Sowerby, Gen.* f. 10.—Nauta hypnorum. *Leach, Syn. Moll.* 110.—Helix marmorata. *Gmel. S. N.* 3665.—Aplexa hypnorum. *Fleming, B. A.* 276.—Aplexus hypnorum. *Gray, Man.* 255.

In ponds and slow streams.

Animal blackish; foot quite as long as the shell; tentacles black.

Shell half an inch long, and a third part as broad, dark horn-colour, glossy and transparent; spire composed of five or six produced and hardly raised volutions, ending rather acutely; aperture narrow-oval, covering about half the shell; the pillar a little sinuate, often of a pale rose-colour.

The eggs are deposited in oblong masses exactly similar to those of *Limnæus*, slightly attached to shells and water-plants. (See *Pfeiffer*, t. 7. f. 24. 27.)

This species was first recorded as British by the industrious Petiver (*Gaz.* t. 10. f. 8.), who found it at Mitcham, Surrey.

***** *Tentacles elongate, linear; jaws three, lateral, rudimentary* (fig. 57.); *shell discoidal.* (Planorbina.)

8. Planorbis. (Coil Shell.)

Animal (fig. 56.) with a small foot; tentacles with an auricle at the base, and a long slender subcentral spiral body, which is covered with an external discoidal dextral shell, the whorls rolling nearly on the same plane; with a lunate or subquadrate mouth, and a simple cavity.

*Fig.* 56.

*Planorbis albus.*

The primary lateral tubercles of the teeth have three apices; and the central tubercle generally in the genus has two apices placed far apart from each other (fig. 9. at p. 61.). This appears be merely the result of the suppression of the third intermediate apex,—a view in which I am borne out by a specimen of the tongue of *P. marginatus*, in which there is only one side apex to the central tooth, the central apex and that on the other side being both suppressed.

In considering these shells as dextral, the spire is that side which is undermost when the mouth is placed on the right side of the spectator, with the most expanded part of the outer lip upwards. It is important to observe this distinction; for Dr. Turton and others, in describing the species, have

sometimes called the under side the upper, and *vice versâ*.

This genus is so named from the flattened and horizontal coil of the volutions, by means of which the whole of the gyrations may be seen on each of the sides.

The smaller species are liable to many distortions. Mr. Sheppard describes a specimen of *P. marginatus* with the volutions nearly disjointed or pulled out; another of *P. spirorbis*, in which the volutions appeared as if pressed out from the base towards the apex, and being almost disjointed, caused the shell to resemble a little basket; another of *P. vortex* with the mouth enlarged and turned over the preceding whorls, which gives the idea of a serpent coiled up. (*Linn. Trans.* xvi. 157.) We have in the British Museum several specimens equally distorted.

The *Planorbes* have been considered by many authors as sinistral shells. M. Desmoulins (*Act. Soc. Linn. Bord.* iv. 273.) examined the question in detail, and came to the following conclusions:—

1. That the shell of *Planorbis* is essentially dextral.

2. The upper part of the shell is invariably indicated by the more advanced edge of the mouth, and not by the sinking in of the tip of the spire, which sometimes does not exist. The monstrosities of these shells, which are not uncommon, also show this structure, as the whorls gradually glide from left to right down the imaginary axis. (See *Michaud*, t. 16. f. 12.)

3. The animal has its three orifices on the left side of the neck, a character which distinguishes it from all the other dextral *Limnæadæ*. But this is only a displacement of the extremities of these organs; for the organs themselves are placed on the right side of the body, as in all the other dextral *Limnæadæ*.

4. Consequently, he adds, the animal of *Planorbis* is essentially dextral, like the shell.

5. The sinistral position of the orifices of the *Planorbis* is the same exception in the Pneumobranchous Mollusca, as the sinistral position of the gills of certain Ptenobranchous Mollusca is amongst the other genera of the order.

Mr. Benson observes: "The animal is considered as sinistral; but if the shell be viewed as such practically, and placed with the side which would in a sinistral shell be accounted the apex, it will be found that the animal is on its back, and that it will have to twist its body half round, in order to gain the ground with its foot; and that, in order to creep with any ease, it must reverse the position of the shell. This is more especially observable in the flatter and more oblique-mouthed species." Mr. Benson considers that face as containing the apex, which is contiguous to the back of the animal. This side may invariably be known in *Planorbis* by the greater projection of the lip in that part, by the deeper depression of the central umbilicus, and by the more considerable involution of the whorls, occasioning the greater depth of the suture. (*Journ. Asiat. Soc. Beng.* 1836, p. 744.)

a. *Spire flattish or slightly concave; whorls not keeled, rounded above and below; mouth semilunar.* (Coretus.)

103. 1. PLANORBIS *corneus.* Horny Coil Shell.—Shell nearly flat above, deeply umbilicate beneath, showing the convex whorls; whorls six, rounded, striated; aperture semicircular. (t. 8. f. 95.)

Helix cornea. *Linn. S. N.* 1243.; *Mont. Test. Brit.* 449.—Planorbis corneus. *Drap. Hist.* p. 43. t. 1. f. 42—44.; *Brard*, p. 147. t. 6. f. 1, 2.; *Sowerby, Genera*, f. 1.; *Jeffreys, Linn. Trans.* xvi.; *Rossm. Icon.* i. f. 86., ii. 14. t. 7. f. 113.; *Turton, Man.* ed. 1. 112. f. 95.; *Leach, Syn.* 112.; *Forbes and Hanley, B. M.* iv. 147. t. 125. f. 4, 5.—Planorbis purpureus. *Müller, Verm.* ii. 154. (not var.).—Helix cornu arietis. *Da Costa, B. C.* 60. t. 4. f. 13.

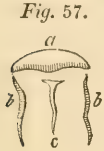
Junior, shell velvety, spirally striated: Planorbis similis. *Müller, Verm.* 166.—Helix nana. *Penn. B. Z.* f. 125.

In muddy streams and ditches.

Animal black. (*Sturm*, t. 40.) The mouth is red-brown. When the mouth is in movement, two small tubercles are to be observed on each side, which are the rudiments of lateral jaws, not found in other species of the genus, but found in the genus *Lymnea.*

The teeth are figured, *Otto Goldfuss*, 48. t. 7. f. *b.*; jaws three,—the upper distinct, crescent-shaped, crenulated, lateral rudimentary, flexuous (fig. 57.). The animal when irritated emits from its

*Fig.* 57.




Jaws of the *Planorbis corneus* magnified.

*a*, Upper jaw; *b b*, Rudimentary lateral jaws; *c*, Mouth closed.

mantle a blood-red fluid similar to that of *Aplysia* in appearance.

Shell an inch in diameter, thick, black, or of a rusty brown colour, obliquely striate; volutions five, the outer one rounded with a deep umbilicus on the under or front side, exposing three of the volutions; upper surface a little concave and whitish; aperture rather oblique, rounded, as high as broad.

b. *Shell concave above; whorls crested or ciliated; mouth roundish.* (Gyraulus.)

104. 2. PLANORBIS *albus.* White Coil Shell. — Shell thin, pellucid, white, concave, and with the whorls equally convex on both sides, with fine raised hispid spiral striæ; mouth roundish-rhombic. (t. 8. f. 97.)

Planorbis albus. *Müller, Verm.* ii. 164.; *Leach, Syn. Moll.* 113.; *Jeffreys, Linn. Trans.* xvi. 387.; *Turt. Man.* ed. 1. 114. f. 97.; *Forbes and Hanley, B. M.* iv. 149. t. 126. f. 1, 2. — Helix alba. *Mont.* p. 459. t. 25. f. 7. — Planorbis hispidus. *Drap. Hist.* p. 43. t. 1. f. 45—48.; *Brard*, p. 159. t. 6. f. 6, 7.; *Lam. Moll.* vi. 154. — Planorbis villosus. *Poiret, Prod.* — Planorbis hirsutus. *Gould, Inv. Mass.* 206. f. 138.? — Gyrulus hispidus. *Hartm. Gast.* t. 25.

In stagnant waters, on aquatic plants.

Animal greyish. (*Sturm*, t. 42.)

Shell about a quarter of an inch in diameter, very thin and brittle, pale horn-colour, marked with very fine close-set raised circular striæ, which are clothed with deciduous bristles, and crossed with obscure longitudinal lines; volutions five, the first very large and rounded; the upper surface a little sunk in the middle, the under side more strongly concave; aper-

ture roundish-oval, dilated, higher than wide, with the upper angle much produced.

When quite fresh, this beautiful species is clothed with a fine velvety pile composed of short points seated on the raised concentric striæ, which fall off with the epidermis, and in its depilated state may be the *Helix spirorbis* of Linné, as he nowhere else mentions so very common a species, Gmelin having probably quoted it twice, both as *H. spirorbis* and *H. alba*. In this state it answers well to his character of *H. spirorbis* in the *Fauna Suecica*,— "testa utrinque concava, plana, albida: anfractibus quinque teretibus."

The *Helix Somershamensis* Sheppard (*Linn. Trans.* xvi. 159.), described as a land shell found on old decayed wood, is said much to resemble this species in shape and appearance. It requires further examination.

105. 3. PLANORBIS *glaber*. Smooth Coil Shell.— Shell rather concave, and whorls equally convex on both sides; brownish horn-colour, semi-transparent, smooth or slightly wrinkled by the lines of growth; with three or four compact and rounded whorls, and a nearly circular aperture. (t. 12. f. 148.)

Planorbis glaber. *Jeffreys*, *Trans. Linn. Soc.* xvi. 387.; *Forbes and Hanley*, *B. M.* iv. 151. t. 126. f. 8, 9.—Planorbis lævis. *Alder*, *Cat. Supp. Trans. Soc. Newcastle*, ii. 337.; *Gray*, *Man.* 261. t. 12. f. 148.

Inhab. ponds, North of England,—Whitley, Northumberland, and Holy Island.

This very distinct species approaches nearest to

*P. albus*, but is smaller, has the whorls more rounded and closer set, and is quite destitute of spiral striæ. It bears considerable resemblance to *Valvata cristata*, especially in its young state, and is often covered with a dark incrustation.

It was discovered by Mr. Alder and the Rev. W. Mark, in Sept. 1832, and first published by Mr. Alder in 1838. It is very like *P. spirorbis*.

Mr. Thompson has also found it at Belfast.

Very like *Planorbis parvus* of Say, from the United States.

Mr. Alder described this species as new, because Mr. Jeffreys sent to him a variety of *P. albus* as his *P. glaber*. (See *Forbes and Hanley, Brit. Moll.* 151.)

Mr. Spence Bate describes the teeth as having more strongly serrated margins to their hooks than those of *P. albus*.

106. 4. PLANORBIS *nautileus*. Nautilus Coil Shell. — Shell depressed, thin, pellucid, rather concave above, flattish beneath; whorls depressed, obtusely keeled, with spinous ridges across the outer whorl; aperture oval, united all round. (t. 8. f. 94.)

Planorbis imbricatus. *Müller, Verm.* ii. 165.; *Drap.* p. 44. t. 1. f. 49—51.; *Brard*, p. 163. t. 6. f. 10, 11.; *Jeffreys, Linn. Trans.* xvi. 388.; *Turton, Man.* ed. 1. p. 11. f. 95.; *Gray, Man.* 261. t. 8. f. 94.; *Leach, Syn. Moll.* 115. — Helix nautileus. *Linn. S. N.* 1241.; *Walker, T. M. R.* f. 20, 21.; *Mont.* p. 464. t. 25. f. 5. — Planorbis nautileus. *Flem. E. Ency.* vii. 69. — Turbo nautileus. *Maton and Racket, Linn. Trans.* viii. 169. t. 5. f. 4. — Planorbis Nautilus. *Flem. B. A.* 278.; *Dupuy, Moll. Gers*, 51.; *Forbes and Hanley, B. M.* iv. 152. t. 126. f. 6, 7.

Var. 1., shell smaller, with the transverse laminæ more remote: Planorbis cristatus. *Drap. Hist.* p. 44. t. 2. f. 1—3.

Var. 2., with the transverse laminæ obliterated.

Monstrosity, with the volutions detached and raised above each other.

In ponds and ditches, on aquatic plants.

Animal grey.

Shell the tenth of an inch in diameter, of a blackish or greenish horn-colour, with three volutions; the epidermis raised into numerous transverse ridges, which form a spinous crest round the outer margin; aperture roundish-oval, united all round, and often detached from the second volution at its narrower end.

M. de Quatrefages observes that, if a young *Planorbis imbricatus* is examined with a weak magnifying power, red blood is to be seen to fill the cavity of the pericardium and the ventricle, and at moments to colour the general cavity of the whole body on its lower surface; he has not seen any distinct globules in this blood; other specimens of a very small size have colourless blood. (*Ann. and Mag. N. H.* xvii. 454, 1844.)

c. *Spire flat; whorls flat above, keeled.* (Gyrorbis.)

107. 5. Planorbis *carinatus*. Carinated Coil Shell. — Shell horn-colour, transparent, striate, nearly flat above, rather convex and with a slight central umbilicus beneath; whorls six, rapidly enlarging, with a prominent obtuse keel in the middle; mouth angular. (t. 8. f. 89.)

Planorbis carinatus. *Müller, Verm.* ii. 157.; *Drap.* p. 46. t. 2. f. 13, 14. 16.; *Brard*, p. 150. t. 6. f. 3.; *Turton, Man.* ed. 1.

t. 16. f. 89. (not 87.); *Leach*, *Syn. Moll.* 114.; *Forbes and Hanley*, *B. M.* iv. 153. t. 127. f. 4, 5.; *Rossm. Icon.* i. f. 60. — Helix carinata. *Mont. T. B.* 451. t. 25. f. 1. — Helix planata. *Linn. Trans.* viii. p. 189. t. 5. f. 14. — Helix planorbis. *Linn. S. Nat.* i. 1242.; *Turton*, *Dict.* p. 45. (not *Da Costa*). — Helix complanata. *Mont. T. B.* 450. t. 25. f. 4. — Planorbis complanatus. *Turton*, *Man.* ed. 1. f. 89. (not description). — Planorbis lutescens. *Jeffreys*, *Linn. Trans.* xvi. 385. (not *Lam.*). — Planorbis planatus. *Turton*, *Man.* ed. 1. 110. f. 92. — Helix limbata. *Da Costa*, *B. M.* 63. t. 4. f. 10., t. 8. f. 8. — Planorbis acutus. *Poir. Prod.* 91. (not *Drap.*) — Planorbis umbilicatus. *Studer*, 92. (not *Müller*).

Var. 1., keel more central, lower disk rather more convex: Planorbis disciformis. *Jeffreys*, *Linn. Trans.* xvi. 521.; *Alder*, *Mag. Z. and B.* ii. 113.

In stagnant waters.

Animal brown.

The animal, according to Montagu, differs from *P. marginatus* in the tentacles being somewhat longer, and particularly in their being pellucid, yellow, and not darker in the middle. (*T. B.* 453.; *Sturm*, t. 43.)

Shell hardly half an inch in diameter, with five volutions, the outer one growing suddenly larger, above nearly flat, beneath rather convex, gradually shelving to the outer edge; in the older specimens the hinder or upper part of the whorls becomes rather convex; colour pale horn-colour and transparent, often covered with a brownish coat; aperture contracted to a point above, in consequence of the keel.

This species is immediately known from *Planorbis complanatus* by the under or front side of the whorls not being so convex and ventricose, by their shelving gradually to the outer edge, and by the hinder or upper part of the whorls of the older shells being rather convex, somewhat like the lower, which has

caused the keel to be considered as central, which it is not.

Dr. Turton's figure of *Planorbis planatus* certainly represents this shell; and probably he only described a young specimen.

Draparnaud and Michaud believe that the *Helix contortuplicata* Gmelin, S. Nat. n. 144. (*Planorbe en vis*, Geoff. 99. t. 3. f. 17, 18.) is only a monstrosity.

Mr. Sheppard describes a monstrosity which had the volutions nearly disjointed or pulled out. (*Linn. Trans.* xvi. 157.)

Mr. Alder observes: "I am not very sure, even after the examination of Mr. Jeffreys' specimen, that I perfectly understand the distinction between *Planorbis disciformis* and *P. carinatus*. The degree of carination is so very variable in different individuals of the same species, that it is rather fallacious as a distinguishing character." On reexamining the specimen here referred to, I could not find any character of importance to distinguish them; and Mr. Jeffreys says, "they are often found living mixed with *P. carinatus*."

In the first edition of this work there was some mistake about the reference to the figures, perhaps occasioned by their being wrongly numbered by the engraver.

*Planorbis marginatus* should have been 87. and not 88.

*Planorbis complanatus* should have been 88. and not 89.

*Planorbis carinatus* should have been 89. and not 87.

This is proved by the size he gives for *Planorbis complanatus*. Rossmässler has partly corrected this error; he truly considers the *P. complanatus* of Turton, as only a state of growth of *P. marginatus*.

108. 6. PLANORBIS *complanatus*. Margined Coil Shell. — Shell horn-colour, brown, semitransparent, striolate, flat or a little concave above, flattish, with a slight central concavity, beneath; whorls rapidly enlarging, flat, and strongly keeled above, ventricose and rounded to the margin beneath. (t. 8. f. 87, 88. 90.)

Helix planorbis. *Linn. Syst.* i. 1242.; part *Penn. B. Z.* ii. t. 83. f. 123.; *Linn. Trans.* viii. 188. t. 5. f. 13. — Planorbis umbilicatus. *Müller, Verm.* ii. 160.; *Jeffreys, Linn. Trans.* xvi. 384. — Helix complanata. *Linn. S. N.* i. 1242. — Planorbis marginatus. *Drap.* p. 45. t. 2. f. 11, 12. 15.; *Rossm. Icon.* ii. t. 2. f. 59.; *Brard*, p. 152. t. 6. f. 5.; *Alder, Mag. Zool. and Bot.* ii. 112.; *Turton, Man.* ed. 1. 107. f. 87.; *Leach, Syn. Moll.* 114. t. 2. f. 7, 8.; *Forbes and Hanley, B. M.* iv. 155. t. 127. f. 1, 2. — Planorbis carinatus. *Studer.* — Planorbis complanatus. *Flem. E. Ency.* vii. 69., *B. A.* 278.; *Turton, Man.* ed. 1. 108. and f. 88. (not 89. as cited). — Helix limbata. *Da Costa, B. C.* 63. t. 4. f. 10., t. 8. f. 8. — Planorbis lacustris. *Ragoum, H. Jour.* i. 273. — Planorbis carinatus, var. *b*. *Drap. Tab.* 46.

Var. 1. Planorbis turgidus. *Jeffreys, Linn. Trans.* xvi. 384.

Var. 2. Helix rhombea. *Forbes and Hanley, B. M.* t. 127. f. 3.; *Turton, Conch. Dict.* — Planorbis rhombeus. *Turton, Man.* ed. 1. 108. f. 90. — Planorbis Sheppardi. *Leach, Syn. Moll.* 115., fide *Cab. Brit. Mus.* — Helix Draparnaudi. *Sheppard, Linn. Trans.* xiv. 158.; *Cab. Brit. Mus.* — Planorbis Draparnaldi. *Jeffreys, Linn. Trans.* xvi. 306. — Planorbis deformis. *Lam.* vi. 154.?

Var. 3., entirely without any keel. *Alder, Catal.* 113.

Monstrosity, with the volutions elevated into a spiral cone, always dextral: Helix terebra. *Turton, Dict.* p. 62. f. 55. — Helix cochlea. *Brown, Wern. Trans.* ii. t. 24. f. 10.

In stagnant waters and slow rivers.

Shell about three quarters of an inch in diameter, very like the last, but thicker and the whorls more rounded, more convex to the edge beneath, and flatter at top or behind; hence the keel has been called marginal, and the mouth is more rhombic and rounded in front; these characters are quite as visible in the young shells. The keel greatly varies in distinctness and prominence, but is never so prominent as in the former species. In some examples it is continued along the edge of the penult turn, in others it is almost altogether obsolete.

These animals breed very rapidly in ponds of the warm water that is emitted from steam engines in Yorkshire; but the specimens which are found in such situations have a great inclination to assume the regular spiral form, with a deep umbilicus. It is to be observed that these shells are all dextral.

There is no doubt but that the *Helix rhombea* of Turton is only the young state of this species; and Dr. Leach's specimen of *Planorbis Sheppardi*, which is the type of Dr. Turton's *P. complanatus*, is evidently the same; his figure is half as large again as the specimens in the Museum. Mr. Sheppard thought it was allied to *P. albus;* and this, perhaps, misled Mr. Alder to think that it might be a variety of that species. (*Mag. Zool. and Bot.* ii. 113.)

Férussac thought that the *Helix rhombea* of Turton was probably a *Scalaris* monstrosity of *H. ericetorum.* (*Fér. Prod.*) Dr. Fleming considered that the *Helix terebra* of Turton might be a distortion of *Helix lapicida;* but Dr. Turton has reduced it to this species.

109. 7. PLANORBIS *vortex*. Whorl Coil Shell. — Shell brown, pellucid, thin, flat above, slightly and regularly concave beneath, with six or seven gradually increasing sharply keeled volutions, which are convex before and flat behind; mouth rhombic, compressed. (t. 8. f. 91.)

Helix vortex. *Linn. S. N.* i. 1242.; *Mont. T. B.* p. 454. t. 25. f. 3. — Planorbis vortex. *Müller, Verm.* ii. 158.; var. *a.*, *Drap.* p. 44. t. 2. f. 4, 5.; *Brard*, p. 154. t. 6. f. 9.; *Lam. Hist.* vi. 154.; *Jeffreys, Linn. Trans.* xvi. 382.; *Rossm. Icon.* 104. t. 2. f. 61.; *Sturm, Fauna*, t. 44.; *Turton, Man* ed. 1. 109. f. 91. *Leach, Syn. Moll.* 112.; *Forbes and Hanley, B. M.* iv. 157. t. 127. f. 6, 7, 8. — Helix planorbis. *Da Costa*, p. 65. t. 4. f. 12. — Planorbis compressus. *Michaud, Compl.* 81. t. 16. f. 6. 8. — Planorbis tenellus. *Studer, Cat.* 92.

Var. 1., the mouth of the shell with a thickened internal rib: Planorbis leucostomus. *Michaud, Compl.* 80. t. 16. f. 3, 4, 5.; *Rossm. Icon.* i. 105. f. 62. — Planorbis rotundatus. *Poir. Prod.* 93.; *Moq. Tand.* ii. 435. t. 30. f. 38—46. — Planorbis vortex *β*. *Drap. Hist.* 45. t. 2. f. 6, 7.

In stagnant waters.

Animal violet-brown.

Shell three eighths of an inch in diameter, very flat and thin, with six or seven gradually increasing volutions, slightly concave above, and quite flattened underneath, so as to form a sharp edge round the outer volution; aperture a little angular.

In summer, when the ditches are dry, this animal closes up its shell with a white *epiphragm*, within which it lies secure under the mud and weeds, in a state of torpidity, until the ditches are again filled with water. The animal then thickens the internal margin of the shell, forming a permanent white rim.

Müller long ago pointed out the white and thickened aperture as an occasional character of this shell,

though he was not perhaps aware of the manner in which it was formed.

110. 8. PLANORBIS *spirorbis*. Rolled Coil Shell.—Shell thin, brown, slightly concave on both sides, with six gradually increasing roundish and nearly equal volutions; mouth roundish. (t. 8. f. 98.)

Helix spirorbis. *Linn. S. N.* 1244.; *Mont. T. B.* p. 455. t. 25. f. 2. — Planorbis spirorbis. *Müller, Verm.* ii. 161.; *Brard*, p. 156.; *Drap. H. M.* ii. t. 2. f. 8, 9.; *Turton, Man.* ed. 1. 115. f. 98.; *Sturm, Fauna*, t. 45.; *Leach, Syn. Moll.* 112.; *Forbes and Hanley, B. M.* iv. 159. t. 127. f. 9, 10.

In ponds and canals.

Shell in flatness and compactness of volutions much resembling the *P. vortex*, but is less and has only six volutions, and is rather thicker; the upper surface is a little concave, in consequence of the volutions being rounded, and the outer one scarcely flattened into a carinated edge; and the aperture is rounded below.

Mr. Alder now believes that *P. vortex* and *P. spirorbis* of Müller are distinct. (See *Alder, Cat. Supp.* 2.)

The peristome is often white-ribbed.

d. *Shell polished; spire deeply umbilicate; whorls slightly keeled; front of shell convex.* (Hippeutis.)

111. 9. PLANORBIS *fontanus*. Fountain Coil Shell.—Shell depressed, dark horn-colour, smooth, glossy, diaphanous, flat above, with a central sunk spire, rather convex beneath; whorls three or four, the outer shelving to a keel in the middle; mouth elongate-angular. (t. 8. f. 93.)

Planorbis nitidus. *Müller, Verm.* ii. 263. (part); *Fleming, B. A.* 278.; *Jeffreys, Linn. Trans.* xvi. 389.; *Alder, Mag. Z. and B.* ii. 114.; *Forbes and Hanley, B. M.* iv. 161. t. 127. f. 11, 12. — Helix fontana. *Lightf. Phil. Trans.* lxxvi. (1786), t. 2. f. 1.; *Montagu*, p. 462. t. 6. f. 6. — Planorbis complanatus. *Drap.* p. 47. t. 2. f. 20—22.; *Rossm. Icon.* ii. 16. t. 7. f. 116.; *Brard*, p. 161. t. 6. f. 4. — Planorbis lenticularis. *Kickx, Moll. Brab.* 67.; *V. Alten; Sturm, Fauna*, vi. 8. 16. — Planorbis fontanus. *Flem. Ed. Ency.* vii. 69.; *Turton, Man.* ed. 1. 110. f. 93.; *Moq. Tand. M. F.* ii. 426. t. 30. f. 10—17. — Helix lenticularis. *V. Alten*, 35. t. 2. f. 4. — Planorbis (Hippeutis) lenticularis. *Hartm.* in *Sturm, Fauna*, t. 16. — Segmentina? fontana. *Beck, Syn. Ind.* 123.

In clear stagnant waters, on aquatic plants.

Animal black.

Shell not a quarter of an inch in diameter, of a dark or whitish horn-colour, very convex beneath, with the centre flattened, above flat, with a central umbilicus; the outer volution slightly but rather sharply carinate near the middle; the front of the shell is regularly convex, has the appearance of being the proper spire, as in *Segmentina*. This shell differs greatly in size and colour; the larger specimens are generally much the darkest, being often reddish-brown.

*Fig.* 58.

c. *Spire deeply umbilicated; whorls rounded before and behind, not keeled, close pressed.* (Bathyomphalus.)

112. 10. PLANORBIS. *contortus.* Twisted Coil Shell. — Shell deeply umbilicate above, nearly flat beneath; whorls eight, convex; suture deep; aperture very narrow, crescent-shaped. (t. 8. f. 96.)

Helix contorta. *Linn. S. N.* i. 1244.; *Montagu*, p. 457. t. 25.

f. 6. — Planorbis contortus. *Müller, Verm.* ii. 162.; *Drap.* p. 42. t. 1. f. 39—41.; *Jeffreys, Linn. Trans.* xvi. 383.; *Rossm. Icon.* ii. 16. t. 7. f. 117.; *Turton, Man.* ed. 1. f. 96.; *Brard*, p. 157. t. 6. f. 12—14.; *Leach, Syn. Moll.* 112.; *Forbes and Hanley, B. M.* iv. 160. t. 126. f. 3. — Helix umbilicata. *Pulteney, Dorset.* t. 20. f. 11. — Helix crassa. *Da Costa, B. S.* t. 4. f. 11.

Inhab. ditches. Common.

Animal grey or blackish. (*Sturm*, t. 41.)

Shell about two tenths of an inch in diameter, and one tenth in thickness, brown horn-colour, and, when free from accidental incrustations, exhibiting in water a bronzed or gilt lustre; volutions five, remarkably compact and equal in size; the upper surface with a large and deep umbilicus; aperture very narrow, crescent-shaped, wider than high, only slightly produced on the under side.

In describing this shell, Dr. Turton called that the upper side which was considered the lower in other species, and *vice versâ*.

### 9. Segmentina *Flem.* (Segment Shell.)

Animal nearly like *Planorbis*, but the shell is polished, and the cavity contracted by permanent internal transverse ridges, having a triradiated opening; lingual teeth very minute.

So called from the internal segments or partitions.

Mr. Alder does not think that the septa in the shell are sufficient to raise it to the rank of a genus, as the animal is exactly like *Planorbis*. Müller confounded it as a variety with *P. fontanus;* like that species, the spire is umbilicated, and the front of the shell has the appearance of being the proper spire.

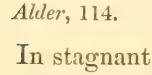
113. 1. Segmentina *nitida*. Glossy Segment Shell. (t. 8. f. 99.)

Planorbis nitidus. *Müller*, ii. 163. 1774; *Drap.* p. 46. t. 2. f. 17—19.; *Turton, Man.* ed. 1. 116. f. 91.; *Pfeiffer*, i. 82. t. 4. f. 12, 13.; *Rossm. Icon.* ii. 15. t. 7. f. 114, 115. — Hemithalamus lacustris. *Leach, Mollusc.* p. 137. — H. nitidus. *Leach, Ann. and Mag. N. H.* xx. 269. — Nautilus lacustris. *Lightf. Phil. Trans.* t. xxvi. (1786), t. 1. f. 1—7.; *Mont.* p. 191. t. 6. f. 3.; *Flem. E. Ency.* vii. 86. — Helix lineata. *Walker, Test. M. R.* t. 1. f. 28. 1784. — Planorbis clausulatus. *Férussac*, 1820; *Potiez and Michaud, Gall.* i. 209.; *Desmoulins, Moll. Girond.* n. 10.—Segmentina nitida. *Flem. Edin. Ency.* xii. — Helix nitida. *Gmel. S. N.* 3624. — Planorbis nautileus. *Sturm, D. F.*; *Kickx, Moll. Brab.* 66. — Segmentina lineata. *Flem. Brit. Anim.* 279., *Treat. Moll. Anim.* t. 7. f. 13.; *Gray, Man.* 271. t. 8. f. 99. — Planorbis complanatus. *Poiret, Prod* 93. (not *Linn. Drap.*) —Planorbis lacustris. *Forbes and Hanley, B. M.* iv. 162. t. 128. f. 123. — Segmentina lacustris. *Swains. Malac.* 338. — Planorbis lineatus. *Jeffreys, Linn. Trans.* xvi. 389.; *Alder*, 114.

In stagnant waters, on aquatic plants.

Shell hardly a quarter of an inch in diameter, highly polished and smooth, of a chestnut or reddish-brown colour, flattish and semitransparent; volutions four, the outer one very large in proportion, and marked with two or three whitish transverse lines exhibiting the internal partitions; the upper surface very convex, with a deep umbilicus in the centre, the under side nearly flat, and umbilicate in the centre; the circumference slightly carinate; aperture oval, inclining to triangular, with the peristome interrupted.

*Fig.* 59.



Except for its internal semiconcamerated partition, this shell exactly resembles the *Planorbis fontanus*, but is larger.

## Class II. CONCHIFERA *Lam.*

The animals without any distinct head, the mouth being situate between the four leaf-like lips; with a more or less distinct, compressed, central foot, enveloped by the two pair of leaf-like gills and the large leaf-like mantle, which are covered by two shelly valves united together by a ligament along their dorsal edge.

This class is divided into sub-classes, orders, and sub-orders, thus:—

Sub-class I. *Mantle leaves connected together with two siphonal openings behind:* Siphonophora.

Order I. Veneracea. — Mantle with two more or less elongated siphonal openings; gills short, not produced into the inhalant or lower siphon; siphons often more or less separate under the hinder adductor muscle.

§ 1. Foot compressed; animal crawling.
1. *Cycladæ.* (p. 250.)

§ 2. Foot conical, acute, angularly bent behind for leaping.

§ 3. Foot truncated and dilated at the end for crawling and anchoring.

§ 4. Foot elongate, slender, strap-shaped, byssiferous for anchoring.
2. *Dreissenadæ.* (p. 258.)

§ 5. Foot very small, rudimentary, byssiferous; hinder adductor muscle large, placed forward in the centre of the lower edge of the shell; pedal opening small in front, near the umbo; anal opening apparently behind and above the adductor muscle.

Order II. Pholadacea. — Mantle with two close more or less elongated siphonal openings under the hinder adductor muscle; gills two pair, produced into the inhalant or lower siphon; pedal opening generally small; siphons united.

Sub-order I. Orthoconchæ. — Body symmetrical; valves equal, gaping at each end; mantle partly exposed; cartilage external or none. Living perpendicularly in holes in rock or ground.

Sub-order II. Heteroconchæ. — Body not symmetrical; valves unequal; cartilage internal in a pit; hinge simple; pedal opening inferior. Living lying on one side, in sand or mud.

Sub-class II. *Mantle lobes mostly free, bearded behind or on the whole edge, sometimes with a separate siphonal opening for the vent:* Asiphonophora.

Order III. Lasiacea. — Mantle lobes united, with an anal aperture under the hinder adductor muscle, and a pedal aperture.

3. *Pisidiadæ.* (p. 263).

Order IV. Unionacea. — Mantle lobes free, slightly united behind, forming a separate anal siphonal opening placed under the hinder adductor muscle.

Sub-order I. Lucinacea. — Foot cylindrical, elongate, inferior; anterior adductor muscle generally elongate.

Sub-order II. Submytilacea. — Foot large, compressed; anterior adductor muscle nearly as large as the hinder; shell free; a periostraca hard and small. Fluviatile.

4. *Unionidæ*. (p. 270.)

Sub-order III. Mytilacea. — Foot small, ligulate, byssiferous; anterior adductor muscle small.

Order V. Pectinacea. — Mantle leaves free all round, without any separate opening for the out-going current and vent.

Sub-order I. Arcacea.—Shell oblong or roundish; the anterior and posterior adductor muscles subequal; mantle bearded behind; hinge teeth deeply grooved or divided into transverse interlocking plates.

Sub-order II. Malleacea. — Shell subdiagonal; anterior adductor muscle small, rudimentary; hinder large, subcentral; gills laminal.

Sub-order III. Ostracea. — Shell suborbicular; anterior adductor muscle obliterated; hinder large, central; cartilage internal; mantle often bearded on the whole edge.

The British fluviatile species belong to four families, which may be thus described:—

1. *Cycladæ.* Shell oblong; hinge with two diverging teeth; mantle lobes free beneath; siphons two; foot oblong, without any beard.
2. *Dreissenadæ.* Shell triangular; hinge toothless; mantle lobes united; siphons two, very short; foot very small, vermiform, with a beard.
3. *Pisidiadæ.* Shell ovate; hinge with two diverging teeth; mantle lobes free beneath; siphons one; foot oblong, beardless.
4. *Unionidæ.* Shell oblong; hinge toothless, or with large lateral teeth; mantle lobes free all round, bearded behind; foot large, oblong, without any beard.

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## Order I. *VENERACEA.*

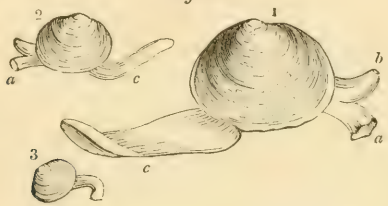
### Fam. I. CYCLADÆ.

Animal with the mantle lobes united at each end; pedal opening moderate; foot compressed, subquadrate, or becoming strap-shaped; siphons united at the base, diverging at the top.

Shell subcordate, porcellanous, thin, covered with a hard, olive, horny periostracum; hinge teeth two or three, diverging; lateral teeth distinct, laminar.

These shells are distinguished from the marine *Veneridæ* by the shell being covered with a hard, olive, horny periostracum.

*Fig.* 60.




1—3. *Cyclas cornea.* — *a*, Lower, *b*, Upper siphon ; *c*, Foot.

As Mr. Jenyns justly observes in his excellent Monograph of the British species of this family, which has here been followed, all the species breed readily in confinement, during the spring and summer months. They are probably oviparous ; and the young appear to remain for a certain period within the folds of the branchiæ previously to their exclusion, since many may be found of different sizes within the parent at one and the same time. They have the faculty of producing long before they are arrived at their full growth ; and even some individuals, which are themselves so immature as to possess hardly any of the distinguishing characters of the species, frequently contain young of a sufficient size to be seen from without through the transparent valves.

When kept alive, they readily and frequently ascend the sides of the vessel, and glide along the surface of the water, with their foot extended on it, and the shell immersed and in an inverted position. In this manner, like the *Limnæi* and other Gaste-

ropods, they contrive to traverse the vessel from side to side, as though they were crawling along a solid plane.

### 1. Cyclas *Lam.* (Cycle.)

Animal with suborbicular mantle produced behind into two elongate contractile siphons; foot tongue-shaped, very extensile; shell suborbicular, nearly equilateral; hind teeth minute, one in the right and two in the left valve; lateral teeth compressed, elongate, lamellar.

The shells are known from *Pisidium* by their being rounder and more equilateral.

a. *Cardinal teeth two, diverging, well developed; shell rounded, and not channelled at the umbones.*

114. 1. Cyclas *rivicola.* River Cycle.—Shell subglobose-ovate, ventricose, rather solid, beautifully and closely striated, greenish brown, with two or three darker bands; edge and lunule yellow; umbones obtuse; cardinal ligament conspicuous. (t. 1. f. 1.)

Tellina cornea, β. *Maton and Racket, Linn. Trans.* viii. 59.; *Turton, Conch. Dict.* 180.; *Wood,* t. 46. f. 3. — Cyclas cornea, *a. Drap. Tabl.* — Cardium corneum, var. *Montagu, T. B.* 86. — Cyclas cornea, *a. Drap. Hist. Moll.* 128. t. 10. f. 1. 3.—Cardium amnicum. *Dorset. Cat.* 32.—Cyclas rivicola. *Leach,* in *Lam. Hist.* v. 558.; *Pfeiffer, L. and W.* 121. t. 5. f. 3. 5.; *Turton, Bivalves,* 248. t. 11. f. 13.; *Fleming, Brit. Anim.* 452.; *Jenyns, Trans. Camb. P. S.* 6.; *Turton, Man.* ed. 1. 12. f. 1.; *Leach, Syn. Moll.* 289.; *Dupuy, Moll. Franc.* 665. t. 29. f. 3.; *Forbes and Hanley, B. M.* ii. 111. t. 37. f. 12. t. 2. f. 1. — Sphærium riviculum. *Mont. Cat.* ii. 30.— Sph. rivicola. *Bourg.* in *Amden,* 6. 1.; *Bourg. Mon.* 12. Young, compressed, pale.

Cyclas æquata. *Sheppard, MSS. Brit. Mus.*

Inhab. rivers Thames, Trent, &c.

The shell is rather solid, opaque within; the umbones paler and often circumscribed with a dark line; length $10\frac{1}{2}$, height $8\frac{1}{2}$, thickness $6\frac{1}{2}$ lines.

115. 2. Cyclas *cornea*. Horny Cycle.—Shell suborbicular, globose, thin, very finely striated; umbones blunt; ligament inconspicuous. (t. 1. f. 2.)

Tellina cornea. *Linn, S. N.* i. 1120.; *Linn. Trans.* viii. 59.; *Don. B. S.* t. 96. — Sphærium corneum. *Scopol. Int. H. N.* 398.; *Bourg. Spær.* 21. — Cyclas scaldiana. *Norm. Cycl.* 5. t. 5. f. 12. — Sphærium scaldianum. *Norm. Cycl.* t. 1. — Sphærium citrinum. *Norm. Cycl.* — Nux nigella. *Humph. Cat.* 59. — Tellina rivalis. *Müller, Verm. Hist.* ii. 202. — Cardium corneum. *Pulteney, Dorset.* 31.; *Mont. T. B.* 86. — Cardium nux. *Da Costa, B. S.* — Cyclas cornea. *Lam. Hist.* v. 558.; *Pfeiffer*, 120. t. 5. f. 12.; *Nilson, Moll. Suec.* 96.; *Turton, Biv.* 248. t. 11. f. 14., *Man.* ed. 1. 13. f. 2.; *Flem. B. A.* 452.; *Jenyns*, l. c. 8.; *Leach, Syn. Moll.* 290.; *Dupuy, Moll. Franc.* 666. t. 29. f. 4.; *Forbes and Hanley, B. M.* ii. 113. t. 37. f. 3. 456. — Cyclas stagnicola. *Leach, MSS. Brit. Mus., Syn. Moll.* 291. — Cyclas cornea β. *Jenyns*, l. c. 8. — Cyclas rivalis. *Drap. Moll.* 129. — Cyclas nucleus. *Stud. Verz.* 93. — Cyclas flavescens. *Macgilliv. Moll. Aberd.* 246. — Cycl. isocardioides. *Norm.* — Cyclas citrina. *Brown, Ill. C.* 132. t. 39. f. 37.

Var. 1. stagnicola. Shell subglobose, rather flattened on the basal edge; umbones tumid, pellucid, very prominent: Tellina stagnicola. *Shepp. Linn. Trans.* xix. 150.

Var. 2. gibbosa. Shell very gibbous; margin very blunt.

Var. 3. compressa. Shell rather compressed, the margin meeting at an acute angle: Cyclas alata. *Leach, Syn. Moll.* 291. (?)

Var. 4. minor. Small, nearly globular.

Inhab. turf-pits, fens of Cambridgeshire.

Animal white; the siphons rather elongate, pale flesh-coloured, upper rather tapering, lower cylindrical, truncated; foot, when expanded, rather longer than the shell.

116. 3. Cyclas *pallida*.—Shell oblong, pale whitish yellow on the circumference, slightly concentrically striated, rounded before, rounded and rather truncated behind; sides rather swollen, evenly convex; the cardinal edge rather produced, nearly straight, and slightly compressed on each side the umbo; the umbo regularly convex, rather in front of the middle of the shell, sometimes slightly crumpled. The foot very large; the siphons elongate, united nearly to the tip; the apices conical, the upper the smallest. The young are compressed, rather rounded, gradually becoming more gibbous and elongated as they increase in size.

*Fig.* 61.

*C. pallida.*

Sphærium pallidum. *Gray, Ann. and Mag. N. H.* vii. 465. 1856.

Inhab. Grand Junction Canal near Kensal Green.

The largest specimens are $\frac{1}{2}\frac{1}{4}$ of an inch long, $\frac{1}{2}\frac{1}{4}$ high, and $\frac{7}{2}\frac{}{4}$ thick. The average-sized specimens are $\frac{1}{2}$ inch long, $\frac{1}{4}$ thick, and $\frac{9}{2}\frac{}{4}$ high.

The living specimens emitted, when in confinement, several young shells about 1 line long.

They are decidedly distinct from any of our British specimens, but bear a very great resemblance to *Cyclas rhomboidea* of Say, found in the rivers of North America. We have unfortunately only a single specimen of this species in the British Museum, which was sent from the Ohio by Mr. Anthony. This example only differs from the specimens found by Mr. Rowse in the front side being rather at-

tenuated and produced, while in the British specimens this part of the shell is regularly rounded; but I have no means of ascertaining whether this is the usual state of the species, or only an accidental variation in the individual we possess, and one can scarcely believe, without better proof, that the same species should be found in Europe and the United States; therefore I shall for the present consider it as distinct.

The species is intermediate in size and form between *Cyclas rivicola* and *C. cornea.*

117. 4. CYCLAS *pisidioides.*—Shell ovate, subtrigonal, involucres olive pale-edged, slightly concentrically wrinkled, rather rounded in front, somewhat produced, with a broad subangular slope behind; the umbones subanterior, regularly convex. Siphons united nearly to the end, the upper shorter, subconic; apertures circular, simple, the lower rather larger, about twice the length of the upper when expanded, cylindrical; the opening circular, simple.

Sphærium pisidioides. *Gray, Ann. and Mag. N. H.* xviii. 25. 1856.

Inhab. Paddington Canal.

The adult shells are 6 lines long, 5 high, and 4 thick. They have much the appearance of a large swollen *Pisidium*, but have the two distinct siphons of the genus *Cyclas.*

The young shells which were deposited in the glass of water during the night were much compressed and nearly regularly oblong. They varied in

size, some being twice as large as the others; the largest were about $1\frac{1}{2}$ line long.

When the siphons are very much extended, the difference in the length between the two is not so great as above, as it is the basal part of the siphons which appears to be the most extensile, the apical parts keeping the same relative length to each other that they did in the less extended state.

I am informed that some British conchologists consider *C. pallida* to be the *C. lacustris* of Draparnaud; it is very unlike the specimens I have received from France and the rest of Europe under that name.

In company with the *C. pallida* described in the last Number of the "Annals," Mr. Rowse finds another species of the genus, which is very distinct from the well-known and generally distributed *C. cornea* in being subtriangular, which gives it much the external appearance of a species of *Pisidium*.

I cannot identify it with any of the species in the British Museum collection, nor can I find any description or figure representing it in any of the works on European freshwater Mollusca; I therefore indicate it as new.

It most resembles some specimens which we have received as *Cyclas tumida* of Pfeiffer; but I do not find any species under that name in Dr. Pfeiffer's work. The Paddington Canal specimens are more inequilateral, longer, and more triangular, having a very distinct hinder slope.

M. Deshayes considers *C. tumida* as only a variety of *C. cornea*.

b. *Cardinal teeth single (rarely two divergent); shell thin, subquadrigonal; umbones prominent.*

118. 5. Cyclas *lacustris.* Capped Cycle. — Shell rather rhombic, compressed, thin, yellowish white, diaphanous; umbones prominent, rather acute, and tuberculose; ligament inconspicuous. (t. 1. f. 3.)

Cardium lacustre. *Mont. T. B.* 89. — Tellina lacustris. *Linn. Trans.* vii. 60.; *Turton, C. D.* 180. — Cyclas calyculata. *Drap.* 130. t. 10. f. 13, 14.; *Lam. Hist.* v. 559.; *Pfeiffer,* 122. t. 5. f. 17, 18.; *Nilson,* 99.; *Turton, Man.* ed. 1. 14. f. 3.; *Dupuy, Moll. Franc.* 672. t. 24. f. 8.; *Forbes and Hanley, B. M.* ii. 118. t. 37. f. 7., t. O. f. 7.—Cyclas lacustris. *Turton, Biv.* 249. t. 11. f. 18.; *Leach, Syn. Moll.* 289. — Tellina tuberculata *Alten, Syst.* 4. t. 1. f. 1. — Cyclas tuberculata. *Klees,* 45. — Sphærium lacustre. *Bourg. Sphær.* 36.—Sphærium Brochonianum. *Bourg. Sphær.* 50. t. 3. f. 5. — Cyclas consobrina. *Féruss.* in *Blainv. D. S. N.* xii.. 279.—Sphærium Deshayesianum. *Bourg. Amœn.* 6.—Sphærium ovale. *Bourg. Sphær.* 31. t. 4. f. 6. 10. — Cyclas lacustris. *Forbes and Hanley, B. M.* ii. 118.

Young, the apex of the shell large relatively to the size of the specimen.

Inhab. rivers.

Var. 1., shell orbicular, less compressed, subdiaphanous, reddish brown.

Cyclas lacustris. *Alder, Cat.* i. 40., *Brit. Mus.* — Cyclas calyculata β. *Jenyns, Monog.* 11.

Inhab. ponds.

Var. 2., shell orbicular, rhombic, rather ventricose, subdiaphanous, reddish; umbones less prominent, blackish.

Cyclas stagnicola. *Leach, MSS. fide Lam.* — Cyclas calyculata, var. 2. *Lam. Hist.* v. 559. — Cyclas calyculata γ. *Jenyns, Monog.* 11.

Inhab. north of England. (*Jenyns.*)

Animal white; siphons white, elongate.

This species, when in confinement, shows more activity than *C. cornea;* they sometimes remain at

the bottom of the vessel with the posterior extremity of the shell elevated, and the siphons exserted.

The cup, or swollen part of the umbo in the ventricose shell of the young animal, remaining on the top of the shell, is common to several species of the family, which, like many other viviparous Mollusca, produce their young of a large size compared with their parent.

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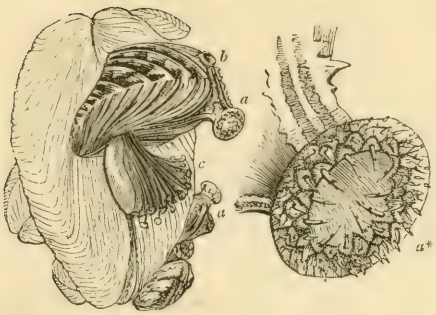
## Fam. 2. DREISSENADÆ.

The mantle entirely close all round, except three apertures, one below for the passage of the foot, and two behind; the upper one a roundish hole, the lower one produced into a conic siphon with a large reflexed mouth, which is broader within; anterior extremity of the body bifurcate and included between the segments of the anterior transverse muscle, which is attached to the front septum of the shell; the abdomen depressed; foot small, elongate-conical, with tuft of byssus at the base, and a distinct byssal groove; the extremities of the gills free throughout their hinder half; anterior adductor muscle small, on a transverse subumbonal plate; mantle edge double.

Shell regular, equivalve, inequilateral, subtrigonal, keeled; beaks terminal, furnished with a septum; muscular scars three, the central one simple linear; hinge toothless; cartilage external, and marginal. Fluviatile.

This genus perhaps bears the same relation to

*Fig.* 62.




Group of *Dreissena polymorpha*, on an old shell.
*a*, Lower siphon ; *a**, magnified: *b*, Upper siphon ; *c*, Byssus.

*Mytilus* as the *Iridinæ* do to the *Uniones*, as they both differ from their apparently allied genera by the adhesion of the lobes of the mantle, and the possession of a siphon; but in our present imperfect state of knowledge of the animals of the *Conchifera*, and of the value of the adhesion or the separation of these parts in a systematic point of view, it may be better to regard them as the type of a distinct family.

The fossil genus *Congeria* agrees with *Dreissena* in many particulars, and perhaps belongs to the same family, if it is in reality a separate genus.

1. Dreissena *Van Beneden.* (Dreissena.)

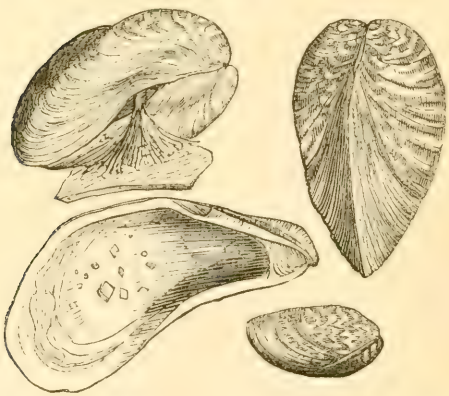
The animal of this genus differs from *Mytilus* in the mantle being closed, while in the latter it is open. In the latter, the retracting muscles are divided into several bundles, each of which has its proper attachment to the shell, while in *Dreissena* these muscular cords are united into a single bundle,

which has only one point of attachment. In *Mytilus*, the branches adhere through their whole length; in *Dreissena*, the extremities are free, and float upon the posterior transverse muscle.

This genus was first established by Mr. Van Beneden. It has also been named *Tichogonia* by Rossmäsler in 1835. He did not know the animal, although it had been described eleven years before by Mr. Sowerby.

119. 1. DREISSENA *polymorpha*. Zebra Dreissena. — Shell triangular, keeled, olive varied with black, wavy-lined.

*Fig.* 63.



Mytilus Volgæ. *Chemn.* xi. 205. f. 2028. — Mytilus polymorphus. *Pallas, Voy. Russ. App.* 211.; *Sow. Gen. Shell*, f. 4. — Mytilus Chemnitzii. *Férussac.* — Mytilus lineatus. *Waardenburg, Mol. Belg.* — Mytilus arca. *Kickx, Monog.* — Mytilus? volgensis. *Gray, Ann. Phil.* 1825, in *Wood, Supp.* t. 2. f. 6. — Mytilus Hagenii. *Baer, Fér. Bull. Sci. Nat.* 1826, 140. — Mytilus Toreyi. *Stenz.* — Mytilina poly-

morpha. *Cantr. Ann. Sci. Nat.* vii. 308. — Tichogonia Chemnitzii. *Rossm. Icon.* i. 1113. t. 3. f. 69. — Dreissena polymorpha. *Van Beneden, Ann. Sci. Nat.* 1835, 210. t. 8. f. 1—11.; *Strickland, Mag. Nat. Hist.* 1838, 361.; *Moq. Tand. Moll. Franc.* ii. 598. t. 54.; *Forbes and Hanley, B. M.* ii. 165. t. 42. f. 4, 5., t. 2. f. 4.

Inhab. lakes and rivers, attached to stones, timber, and other shells.

The fact of this animal having been introduced was first brought before the public on Nov. 2. 1824, by Mr. James de Carle Sowerby, when he presented some specimens to the Linnæan Society, stating them to be "probably the *Mytilus polymorphus* Gmelin, 3363, which is found in abundance, attached to shells and timber, in the Commercial Docks, by James Bryant, Esq., who uses the animal as bait for perch." Mr. Sowerby observes that "the strong resemblance which it bears to the marine *Mytili* is very remarkable. Independently, however, of the *septa* within the valves, there are many other differences to be observed, several of which are in the structure of the included animal, although it possesses a strong byssus. Among others, the foot is small and the lips of the mouth are differently placed, being more like those in the animal of the *Unio ovalis*. It has two tubes; and the mantle is united almost all round, and bordered with a bright orange between two bands of black. Some of the septa within the beaks appear to be a kind of disease, as they are not constant.

"The same species is found in the Danube and in the rivers of Russia; but the British species are much larger and finer than any foreign one I have seen." (*Linn. Trans.* xiv. 585.)

In 1825, in a List of Shells not taken notice of by Lamarck (*Ann. Phil.* 1825), I stated that this shell would "perhaps form a genus distinct from *Mytilus*, and peculiar for its fresh-water habitation," and added that, "like Mollusca of that station, the animal can live for a long time out of water. I have kept one for three weeks, when it was still healthy. It is found in the Commercial Docks, where it most likely has been introduced with timber from the Volga."

I am now confirmed in the idea that they were introduced in this way, as a friend has informed me that he has seen them sticking to the logs of Baltic timber before it was unloaded from the ship. (See *Wiegmann, Arch.* 1838.) In the dock they attach themselves to stones, *Uniones*, *Anodons*, and the walls of the docks, as well as to the logs.

This species illustrates how rapidly molluscous animals may become naturalised, and spread over a great extent of country; for Mr. J. de C. Sowerby, in 1825 (*Zool. Journ.* i. 584.), first recorded it as naturalised in the Commercial Docks, where he observed that it had probably been brought with the timber; it has since been widely extending itself, and is now to be found in most of the docks connected with the Thames. In 1834, Mr. Stark communicated to the Wernerian Society the discovery of this species in the Union Canal, near Edinburgh; and, in 1836, the Rev. M. J. Berkeley, the eminent cryptogamic botanist, and Mr. J. Streatfield, discovered it on the piers of the bridge which crosses the Nen at Fotheringay, and again, a little

higher up the same river, on stones of a small overfall at Tansor: he believes they were introduced from Wisbeach on timber since 1828.

It has been naturalised in Holland and on the Rhine. It is also found with tertiary fossils in Transylvania, Moravia, and near Vienna.

Mr. Lyell (*Geol.*), not being aware that these animals had the power of living a long time out of water, and that they were most probably brought in the holds of ships with the Baltic timber, and thus introduced into our docks, where the timber is unloaded, believes that the animals attached themselves to the bottoms of Baltic ships, and in this manner were obliged to pass through the sea, before being again brought to their natural station in fresh water. And Mr. Garner, in his curious but rather crude paper on the anatomy of Lamellibranchiata (*Mag. Nat. Hist.* n. s. iii. 303.), ventures to explain this theory by supposing that the animals "kept their valves constantly closed" during the voyage through the sea to the fresh water!

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## Order III. *LASIACEA.*

### Fam. 3. PISIDIADÆ.

Mantle lobes united; pedal and branchial opening inferior; syphon conical, more or less elongate; foot lanceolate, compressed, not byssiferous;

gills two on each side; shell equivalve; cardinal teeth two, diverging; lateral teeth distinct.

*Fig.* 64.

*Pisidium amnicum.* — *c*, Foot; *d*, Single siphon.

### 1. Pisidium. (Pera.)

Mantle extended behind into a short, simple, contractile siphon; foot tongue-shaped, very extensile; shell suboval, wedge-shaped, inequilateral; hinge teeth and lateral teeth like *Cyclas*.

This genus was first distinguished by Scopoli: it has since been established, from characters drawn from the animal by Pfeiffer, under the name of *Pisidium*. Leach long ago separated it in his MSS. under the name of *Pera*, and afterwards of *Euglesia;* and the shells, with his names attached to them, were long exhibited in the British Museum collection, before they were described by Mr. Jenyns.

a. *Shell very slightly inequilateral, nearly rounded.*

120. 1. Pisidium *obtusale*. Gibbous Pera. — Shell globose, obliquely subovate, shining, very finely striated, greenish black, with a yellowish marginal zone, rarely all yellowish; umbones rather prominent, very blunt. (t. 12. f. 149.)

Cyclas gibba. *Alder*, *Cat.* 41. — Tellina minima. *Studer*, *Coxe's Trav.* iii. 439. — Cyclas minima. *Studer*, *Verz.* 93. — Pisidium obtusale. *Pfeiffer*, 125. t. 5. f. 21, 22.; *Jenyns*,

*Monog.* 13. t. 20. f. 1. 3.; *Forbes and Hanley, B. M.* ii. 120. t. 36. f. 1. — Cyclas obtusalis. *Lam. Hist.* v. 559. — Pera gibba. *Leach, MSS. Brit. Mus., Syn. Moll.* 292.; *Dupuy, Moll. Franc.* 690. t. 31. f. 4. — P. fontinale obtusale. *Held, Isis*, 1837, 306. — P. (Cyclas) fontinalis, var. obtusalis. *Dupuy, Moll. Gers*, 89.

Young, the yellow zone broader.

Var. 1., shell ovate, trigonal, very ventricose, blackish or ochraceous; the edge very blunt: Cyclas obtusalis. *Nilson*, 101. — Cyclas obtusale β. *Jenyns, Monog.* 13.

Inhab. small splashy pools and other stagnant waters.

Animal white; siphons short, obconic; foot very extensile.

Mr. Jenyns observes: "It is by far the most active and lively species that I am acquainted with, being always in motion, and residing less at the bottom than the rest of the family."

121. 2. PISIDIUM *nitidum*. Shining Pera. — Shell orbiculate, oval, very shining, finely striated; umbones rather blunt, with a few deeper striæ; cardinal and lateral teeth moderate, thin. (t. 12. f. 50.)

Pisidium nitidum. *Jenyns, Monog.* 16. t. 20. f. 7, 8.; *Forbes and Hanley, B. M.* ii. 126. t. 37. f. 14. — P. incertum. *Norm. Cycl.* 6. — Cyclas nitida. *Hanley, Sp. Shell*, i. 90., *Supp.* t. 14. f. 46.

Inhab. clear water, Cambridgeshire, Battersea Fields. (*Gray.*)

Animal white; siphon short, funnel-shaped, with a spreading mouth, and a more or less plaited crenated edge.

This shell may easily be distinguished by the deeper grooves on the umbo, which are more easily seen in the living specimens.

122. 3. PISIDIUM *pusillum*. Minute Pera. — Shell orbicular, ovate, rather compressed, very finely striated, scarcely inequilateral; umbones rather prominent, acute. (t. 1. f. 7.)

Tellina pusilla. *Turton*, *C. Dict.* 167. — Cyclas pusilla. *Turton*, *Biv.* 251. t. 11. f. 16, 17., *Man.* ed. 1. 16. f. 7. — Cyclas fontinalis. *Nilson*, 101.; *Drap.* 130. t. 10. f. 8. 11. — Cyclas gibba. *Alder*, *Cat.* 41. — Euglesia Henslowiana. *Leach*, *MSS. Brit. Mus.*, *Syn. Moll.* 291. — Pisidium pusillum. *Jenyns*, *Monog.* 14. t. 20. f. 4. 6.; *Moq. Tand. M. F.* ii. 587. t. 52. f. 38—42.; *Forbes and Hanley*, *B. M.* ii. 123. t. 37. f. 11., t. O. f. 9.—Pisidium fontinale. *Pfeiffer*, *D. M.* i. 125. t. 5. f. 15, 16.

Inhab. ponds.

b. *Shell inequilateral.*

123. 4. PISIDIUM *pulchellum*. Beautiful Pera. — Shell oblique-ovate, ventricose, deeply striated; umbones rather blunt, simple. (t. 12. f. 151.)

Pisidium pulchellum. *Jenyns*, *Monog.* 18. t. 21. f. 1.; *Forbes and Hanley*, *B. M.* ii. 128. t. 27. f. 12, 13. — Pisidium cajetanum δ pulchellum. *Moq. Tand. M. F.* ii. 584. t. 52. f. 24. 28. — Cardium amnicum jun. *Montag. T. B.* 88.

Var. 1., smaller; shell thin, finely striated, umbones rather acute.

Pera pulchella. *Leach*, *MSS. Cab. Brit. Mus.*, *Syn. Moll.* 292. — Pisidium fontinale. *Pfeiffer*. — Cyclas fontinalis. *Brown*, *Edin. Journ. N. and G. Soc.* i. 11. t. 11. f. 5. 7.; *Alder*, *Cat.* 41. — Pisidium pulchellum β. *Jenyns*, *Mon.* 18. t. 21. f. 2, 3.

Var. 2., shell obliquely oval, finely striated, compressed; margin acute. Pisidium pulchellum γ. *Jenyns*, *Mon.* 18.

Var. 3., shell rather oblong, very ventricose, deeply striated; edge very blunt, hinge margin nearly straight. Pisidium pulchellum δ. *Jenyns*, *Mon.* 18. t. 21. f. 4, 5.

Inhab. ponds, Birkham Common, Surrey.

Animal white; siphon variable, conical or elongate, with an entire or lobed end.

The siphonal tube assumes a variety of appearances even in the same individual; and it is very interesting to watch, under a low power of the microscope, the striking and rapid changes of form through which it passes in a short time.

Mr. Jenyns tells me that later research has induced him to believe that vars. 1. and 3. are a distinct species, for which he would retain the name of *P. pulchellum*, while I would propose the name of *P. Jenynsii* for the other varieties.

124. 5. PISIDIUM *Henslowianum*. Appendaged Pera. — Shell obliquely oval, ventricose, finely striated; umbones rather acute, with a laminar projection; cardinal teeth not prominent, rudimentary, imperfectly disposed in a reversed V; lateral teeth large and thick. (t. 1. f. 6.)

Pera Henslowiana. *Leach*, *MSS.* — Tellina Henslowiana. *Leach*, *MSS.*, *Syn. Moll.* 291.; *Forbes and Hanley*, *B. M.* ii. 131. t. 37. f. 11.; *Shepp. Linn. Trans.* xiv. 150. — Pera appendiculata. *Leach*, *MSS. Brit. Mus.*, *Syn. Moll.* 292. — Cyclas appendiculata. *Turton*, *Man.* ed. 1. t. 15. f. 6. — — Pisidium Henslowianum. *Jenyns*, *Mon.* 20. t. 21. f. 6, 7.; *Moq. Tand. Moll. Franc.* 581. — Pisidium acutum. *Pfeiffer*, in *Wiegm. Arch.* 1831, 230. — Pisidium pallidum. *Gass. Pisid. Aquit.* t. 1. f. 10. — P. Bonnafouxianum, and P. Tandonianum. *Cess. Nouv. Pisid.* 6. — P. Dupuyanum. *Norman*, *Cycl.* 5. — P. Recluzianum. *Bourg. Jour. Conch.* 1852, 174. t. 8. f. 8.

Inhab. rivers and ponds.

Animal white; siphon short, rather variable, generally rather conical and truncated, entire.

This shell is easily known by the curious eave-like projections on the umbones, which are evidently formed on the edge of the very young specimen, and

then gradually rise to the umbo as the shell increases in size by the addition of new laminæ of shelly matter to its edge.

The apex of the umbo is sometimes deficient.

125. 6. PISIDIUM *amnicum*.—Shell ovate, ventricose, deeply sulcately striated; umbones rather blunt, simple; cardinal teeth prominent, well developed, diverging like a V; lateral teeth moderate, thin. (t. 1. f. 5.)

Tellina amnica. *Müller*, ii. 205.; *Linn. Trans.* viii. 60.; *Dillwyn, D. Cat.* i. 105.; *Turt. Dict.* 168.—Tellina striata. *Schroet. Flussconch.* 193.—Tellina rivalis. *Maton, Linn. Trans.* ii. 44. t. 13. f. 37, 38.; *Don. B. Z.* t. 64. f. 2.—Cordula amnica. *Leach, Syn. Moll.* 293.—Cardium amnicum. *Montag. T. B.* 86.—Cyclas palustris. *Drap.* 131. t. 10. f. 15, 16.—Cyclas obliqua. *Lam. Hist.* v. 559.; *Nilson*, 99.—Pisidium obliquum. *Pfeiffer*, 124. t. 5. f. 19, 20.—Cyclas amnica. *Fleming, B. A.* 453.; *Turt. Biv.* 250. t. 11. f. 25., *Man.* ed. 1. 15. f. 5.—Pisidium amnicum. *Jenyns, Mon.* 21. t. 21. f. 2.; *Moq. Tand. M. F.* ii. 533. t. 52. f. 11—15.; *Forbes and Hanley, B. M.* ii. 133. t. 37. f. 8, 9., t. O. f. 8.—Cyclas Pfeifferi. *Ziegl.*—Pisidium intermedium. *Gass. Pisid. Aquit.* 11. t. 1. f. 4.—P. Grateloupeanum. *Norm. Cycl.* 4.—P. inflatum. *Megerle.*

Young shell rather compressed; umbones scarcely prominent.

Var. 1., shell with very deep grooves. Pera fluviatilis. *Leach, MSS.* in *Brit. Mus., Syn. Moll.* 292.—Pisidium amnicum β. *Jenyns, Mon.* 22.

Var. 2., shell nearly smooth, with slighter striæ. Pera Henslowiana. *Leach, MSS. Brit. Mus.*—Pisidium amnicum γ. *Jenyns, Mon.* 22.

Inhab. rivers and gently running streams, residing wholly at the bottom, and partly buried in the mud.

Animal white; siphon rather variable, obliquely truncated.

126. 7. PISIDIUM *cinereum*.—Shell greyish or cinereous, rather compressed, oval, finely striated,

and with two or three deep sulcations, forming darker zones across the shell; margin of the valves meeting at a rather acute angle; umbones obtuse, and not much produced, sometimes slightly capped, as in *C. calyculata;* cardinal teeth rather prominent; lateral moderate and thin. (t. 12. f. 152.)

Cyclas cinerea. *Hanley, Recent Shells*, i. 90. t. 14. f. 44. — Pisidium cinereum. *Alder, Cat. Supp.* 4.; *Forbes and Hanley, B. M.* ii. 125. t. 36. f. 2. — Cardium cajertanum. *Poli, Sicil.* i. 65. t. 16. f. 1.—Pisidium cajertanum. *Bourg. Voy. Mer. Mort.* 80.; *Moq. Tand. Moll. Franc.* ii. 584. t. 52. f. 16—32.—Pisidium australe. *Philip. Sicil.* i. 39.— Cyclas lenticulare. *Norm. Cycl.* 8. t. 8. f. 7, 8. — P. lenticulare, *Dup. H. M.* 681. t. 30. f. 2. — P. tetragonum. *Norm. Cycl.* 5. — P. thermale, P. normandianum, P. Iratianum, P. Gassierianum, and P. calyculatum. *Dupuy, Cat.* — P. limosum. *Gass. Moll. Agen.* 206. t. 2. f. 10, 11.

Distorted: P. sinuatum. *Bourg. Jour. Conch.* 1851, 421., 1852, 49. t. 1. f. 6—10.

Var., more ventricose, and produced at the umbones.

Inhab. ponds, North of England.

Animal white; siphonal tube very short, broad, and flat, truncated at the end, and seldom protruded much beyond the edge of the shell.

This species may generally be readily distinguished from others of the genus by its more compressed and oval form, and its cinereous colour. It is the largest of the minute species. (*Alder.*)

Length 2-10ths, height 7-40ths, thickness 5-40ths of an inch.

The genus *Cyrena* is now no longer found alive in this country, but it must have lived here at no very great period of time (geologically considered), for it is found an abundant fossil at Grays, in company

with a quantity of other fresh-water and land shells, all now found alive in the neighbourhood, as *Pisidium amnicum*, *Valvata obtusa*, &c. &c.

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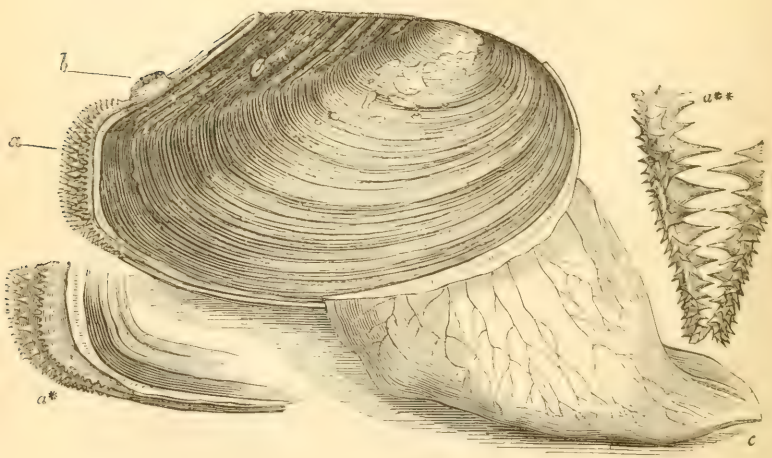
## Order IV. *UNIONACEA.*

### Fam. 4. UNIONIDÆ.

Animal with mantle lobes free all round except at the back, the hinder edge forming, when in conjunction, two holes for the passage of the water, food, and rejectamenta, the upper (*b*) small, simple, the lower (*a*, *a**, *a***) bearded

*Fig.* 65.




*Anodon cygneus.*

*a*, Lower siphon; *a**, *a***, magnified: *b*, Upper siphon; *c*, Foot.

on the edge; foot (*c*) compressed, ovate, subquadrate.

Shell oblong-elongate, equivalve, inequilateral, solid, internally pearly, covered with a hard olive or black horny periostracum; hinge without any true cardinal teeth, with irregular anterior, and long laminar posterior lateral teeth, or toothless; muscular scars numerous; ligament and cartilages external, elongate, strong.

These animals live sunk perpendicularly in the mud of rivers, with the front end downwards, and the siphonal edge even with the surface of the mud, but sinking themselves deeper when disturbed; they are also found under the shelter of stones in rivers and running water with stony banks.

The family contains three genera:—

1. *Anodon.* Hinge toothless.
2. *Alasmodon.* Hinge with short anterior teeth.
3. *Unio.* Hinge with short anterior and long posterior teeth.

### 1. ANODON *Lam.* (Fresh-water Muscle.)

Shell oblong, thin, rather compressed behind; hinge margin toothless; gills formed of waved tubes, forming a kind of trellis.

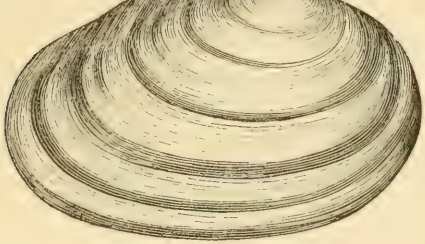
127. 1. ANODON *cygneus.* Swan Fresh-water Muscle.—Shell oval, tumid, rounder and ventricose in front, compressed and more or less angular above behind, covered with an olive periostracum. (t. 1. f. 8.)

Symphonota cygnea. *Lea, Obs. on Unio*, i. 70. — Anodontiles cygneus, and A. anatina. *Poiret, Prod.* 109. — Anodonta variabilis. *Drap. Tabl.* 108.; *Moq. Tand. Moll. Franc.* 561. t. 45. f. 5, 6. — Mytilus radiatus. *Müller, Verm.* ii. 209. — Mya arenaria. *Schroet, F. C.* 169. t. 2. f. 1. — Mytilus zellensis. *Gmel. S. N.* 3262. — Anodonta sinuosa. *Maud. Moll. Vienn.* 15. — A. paludosa. *Turt. Biv.* 240. t. 15. f. 1. Anodonta europæa. *Leach, Syn. Moll.* 326. — Anodonta cygnea. *Drap. H. Moll.* 134.; *Lam.*; *Pfeiffer*, i. 3. t. 6. f. 4.; *Rossm. Icon.* t. 3. f. 67., t. 5. f. 342. — Mytilus cellensis. *Schroet. Flussc.* t. 2. f. 1. — Anodonta sulcata. *Lam. Hist.* v. 85.; *Pfeiffer*, i. 110. t. 6. f. 1., ii. 6.; *Nilson*, 113. — Mytilus anatinus. *Linn. Trans.* viii. t. 3. *a.* f. 1., xiii. t. 5. f. 5. — Anodon cygneus. *Turton, Man.* ed. 1. f. 8.; *Drap. Moll.* i. 12. f. 1. ? — Anodonta cellensis. *Rossm. Icon.* t. 19. f. 280. ? — Anodon paludosus. *Turton, Biv.* 240. t. 15. f. 6. — Mytilus stagnalis. *Sow. Brit. Miscel.* and *Brit. Mus.* — Mytilus dentatus. *Turt. Conch. Dict.* 115. — Anodonta crassiuscula, A. parvula. *Drouet, Anod. Aub.* 5. — Anodonta minima. *Millet, Moll. Ang.* 241. t. 12. f. 2. — Anodonta Rayii, A. rostrata. *Dupuy, Cat.* — Anodonta coarctata. *Pot. and Mich. Gall. M.* 142. t. 55. f. 2. — A. Moulinsiana. *Dupuy, Hist. Moll.* 616. t. 20. f. 19. — A. Scaladiana. *Dupuy*, l. c. t. 29. f. 12. — A. arelatensis. *Jacquem.* 125. — A. ovalis. *Pot. and Mich. Gall.* ii. 145. — A. Milletii. *Ray and Drouet, Rev. Zool.* 1848, t. 1. f. 1, 2. — Mytilus cygneus. *Schroet. Flussc.* t. 1. f. 1.; *Penn. Brit Zool.* iv. t. 67. f. 78.; *Linn. Trans.* viii. t. 3. *a.* f. 2., xiii. t. 5. f. 3.; *Montagu, T. B.* 170. — Mytilus maculatus. *Linn. Trans.* xiii. t. 5. f. 6. (young). — Anodonta piscinalis. *Nilson*, 116. n. 3.; *Schroet. Flussc.* t. 3. f. 1. ?; *Drap.* t. 12. f. 2.; *Rossm. Icon.* t. 19. f. 281., t. 30. f. 416. (var.). — Anodonta ventricosa. *Pfeiffer*; ii. 30. t. 3. f. 1. 6. — Anodonta rostrata. *Kokeil. MSS. Rossm. Icon.* t. 20. f. 284. — Anodonta complanata. *Ziegl. MSS.*; *Rossm. Icon.* i. 112. t. 3. f. 68., iv. 24. t. 20. f. 283.; — A. Normanda. A. Iobæ. *Dupuy, Cat.* 21. — A. elongata. *Holandre, Faun. Mosell.* 56. — A. Gratelupeana. *Gass. Moll. Agen.* 193. t. 3, 4. f. 2. — Anodonta compressa. *Menke, Syn.* 106. — Anodonta rhombea. *Schlüt.* — Anodonta intermedia. *Lam. Hist.* vi. 86.; *Pfeiffer*, i. 113. t. 6. f. 3., ii. t. 5. f. 1. 6.; *Kenyon, Mag. N. Hist.* 1. f. 188. — A. oblonga. *Millet, Moll. Ang.* i. 242. t. 2. f. 1. — Anodonta ponderosa. *Pfeiffer*, ii. 31. t. 4. f. 1—6.; *Rossm. Icon.* iv. t. 20. f. 282. — Mytilus cygneus *β*. *Linn. Trans.* viii. t. 3. *a.* f. 3. — Mytilus incrassatus. *Shepp. Linn. Trans.* xiii. t. 5. f. 4. — Mytilus avonensis. *Mont. T. B.* 171.; *Linn.*

*Trans.* viii. t. 3. *a.* f. 4. — Anodonta crassa. *Marks, MSS.* —Mytilus (A.) piscinalis. *Gass. Moll. Agen.* 191. t. 4. f. 1.—A. subponderosa. *Dupuy, Cat.* n. 29. — A. Rossmassleriana. *Dupuy, Moll. Gers.* 74. — A. Dupuyi. *Ray and Drouet, Rev. Zool.* 1849, 14. t. 1, 2. — Anodonta anatina. *Pfeiffer*, i. 112. t. 6. f. 2.; *Schroet. Flussc.* t. 1. f. 3.; *Rossm. Icon.* t. 30. f. 417—420.

Inhab. rivers, ponds, and ditches.

*Fig.* 66.



*Anodon cygneus avonensis.*

The Anodons live in lakes, ponds, marshes, and muddy rivers, crawling slowly on the mud, and leaving a more or less marked groove after them. In the winter, and especially in the summer when the water dries up, they bury themselves in the mud. They feed on decomposed animal and vegetable substances; and the size and solidity of the shell depends on the abundance of the food and the state of quietness or motion and of calcareous matter in the water in which they happen to reside. Some authors have believed them to be unisexual; but their anatomy proves that they are hermaphrodite and sufficient for themselves. Pioret supposed that of the two species he observed near Paris, one was viviparous and the other oviparous; but they all

deposit eggs, which are developed in the interior of their exterior pair of gills. They have been divided into numerous species, every river and lake or pond having its peculiar kind; but in ponds where there is plenty of food (and a dead dog or cat or fish affords abundance of such material), and where the water is nearly stagnant and seldom disturbed, they become of a large size, with ventricose thin shells, while in more rapid rivers with pure clear water, with very little decomposed animal or vegetable matter held in suspension, they are small, with compressed thick shells; and all intermediate forms and sizes are to be observed. After collecting many hundred specimens from various localities, I am convinced that there is only a single species found in this country.

A most variable species, which appears to assume different appearances under every circumstance, as, for example, the depth, the stillness or motion, and the purity or impurity, or peculiar impregnation of the water in which it happens to be located.

Mr. Alder considers *A. cygnea*, *A. cellensis* Pfeiffer, *A. intermedia* and *A. anatina* Lam., and *A. ventricosa* Pfeiffer as distinct British species. (*Mag. Zool. and Bot.* ii. 118.)

Mr. Sheppard, after describing the four species, as he considers the varieties of this species to be, sums up as follows:—To bring the specific differences above enumerated into one point of view, *M. anatinus* is distinguished from *M. cygneus* by its anterior (posterior) area running parallel with its base; again, from *M. macula* by the interior area of the latter

sloping upwards, and forming an angle with the fore part of the shell. In *M. cygneus* the base slopes upwards; and *M. incrassatus* differs from them all by its large exserted ligament, superior roughness of the outside, and in having the posterior part, in a slope from the umbones to the base, incrassated. (*Linn. Trans.* xiii. 87.)

The Abbé Dupuy divides the French species into sections, thus: —

*a. Cygnæi.* — Shell very large, thin, with the muscular scars scars slightly marked.

1. A. cygnæa.

*β. Ponderosa.* — Shell large, very thick, especially in front, muscular scars deep.

2. A. ponderosa, *Dupuy*, t. 1. f. 12. — 3. A. Dupuyi, t. 17. f. 13. — 4. A. subponderosa, t. 17. f. 14. — 5. A. Rossmassleriana, t. 18. f. 14.

*γ. Anatina.* — Shell small, generally shorter and thinner than the preceding, with the muscular scars less deep.

6. A. anatina, t. 19. f. 13, 14.; t. 20. f. 20. — 7. A. piscinalis, t. 19. f. 17, 18. — 8. A. scaladiana, t. 19. f. 12. — 9. A. Rayii, t. 20. f. 22. — 10. A. coartata, t. 20. f. 21. — 11. A. Milletii, t. 21. f. 16.

*δ. Hiantes* — Shell middle size or small; valves more gaping on the lower front edge than the preceding.

12. A. Gratelupeana, t. 17. f. 22.

I believe that these are all varieties of the same species, the size and thickness of the shell depending on the quantity of food and calcareous matter in the pond or river, and the depth of the scars on the thickness of the shell.

M. Moquin Tandon, in the last work on the French Mollusca, reduced the species inhabiting that country to four, viz., *A. cygnea*, *A. anatina*, *A. complanata*, and *A. variabilis*, each with several varieties; yet when you consider the characters by which they are attempted to be divided, it is very evident that, as in England, only a single species is found in France.

### 2. Alasmodon *Say.* (Pearl Muscle.)

Shell oblong-elongate; hinge with short crested irregular anterior teeth in the right valve, shutting between two in the other valve; posterior lateral teeth small in the young, and wanting in the adult shells; gills formed of straight tubes, and resembling a kind of trellis-work.

Found in rapid rivers.

This genus was established by Say: Dr. Leach named it *Damaris*, and Dr. Turton has retained for it the generic name of *Unio;* but, as this genus was before named by Say, and *Unio* is generally kept for the following genus, we are induced to adopt Say's name.

128. 1. ALASMODON *margaritiferus*. Pearly Alasmodon.—Shell ovate-elongate, rather compressed, thick, heavy, black-brown, truncated below; cardinal teeth thick, conical. (t. 2. f. 9.)

Young with small posterior lateral teeth, like *Unio*.

Unio riparia. *Pfeiffer*, t. 5. f. 13.?? — Unio margaritifera. *Pfeiffer*, ii. t. 7. f. 1.

Mya margaritifera. *Linn. Fauna Suec.* 516., *Syst. Nat.* ii., *List. Conch.* 149.; *Schroet. Flussc.* 168. t. 4. f. 1. — Unio margaritiferus. *Retz. Nov. Gen.* 16. 1788.; *Nilson*, 103. n. 1.; *Turton*, *Biv.* 242. t. 16. f. 1., *Man.* ed. 1. 19. f. 9.; *Forbes and Hanley*, *B. M.* ii. 146. t. 38. — Unio margaritifera. *Drap.* 132. t. 10. f. 17—19.; *Pfeiffer*, i. 116. t. 5. f. 11. — Unio sinuata. *Lam. H.* vi. 70.; *Pfeiffer*, ii. 33. t. 7. f. 4. — Unio margaritifer. *Rossm. Icon.* i. 122. f. 72. 74., ii. 21. f. 129. — Unio elongatus. *Nilson*, 106. n. 2. — Unio elongata. *Lam. Hist.* vi. 70.; *Mich. Compl.* 113. t. 16. f. 29.—Unio Roissyi. *Mich. Compl.* 112. t. 16. f. 28.; *Proceed. Brit. Assoc. for* 1838. — Unio margaritifera, forma Roissyi. *Forbes*, *Malac. Mon.* 44. — Alasmodon margaritiferum. *Fleming*, *B. A.* 417. — Damaris elongata. *Leach*, *Syn. Moll.* 322. — Margaritana fluviatilis. *Schum. N. Syst.* 124. — Alasmodon margaritiferus. *Gray*, *Man.* 293. — Margaritana margaritiferus. *Dupuy*, *Cat.* n. 213. — U. margaritana margaritifer, and Lymneus sinuatus. *Moq. Tand. Moll. Franc.* ii. 266, 267. — Unio rugosa. *Poir. Prod.* 205. —Unio crassissima. *Féruss.*; *Des Moul. Moll. Girond.* 42.— Unio sinuatus. *Ross. Icon.* n. 3. — Unio brunnea. *Ponti*, *Bivalve Rodez*, 430.

Inhab. mountain rivers with a rocky bed.

M. Moquin Tandon divides these species between two sub-genera, one, *Margaritana margaritifer*, and the other, *Lymneus sinuatus*, the latter being the adult shell.

The young specimens are oblong, without any contraction in the lower edge; and in some rivers the shell appears to retain this appearance in its adult

age; and it has hence been regarded as a species by Michaud and others, under the name of *U. Roissyi*. But in general, as they enlarge, they become much eroded about the umbones, and the lower margin is more or less drawn in. In this state it is the *U. elongatus* of Lamarck. I do not know whether the erosion of the beak has anything to do with the contraction of the lower edge; but all the oblong regular specimens I have seen have the periostraca of the beaks only slightly worn, while, on the contrary, all those that have the beaks much and extensively eroded belong to the other variety; and the extent of the inflection generally agrees with the state of the umbo.

Figure 9. of Plate 2. represents the intermediate state between the two varieties; and figure 10. much more resembles a younger specimen, both in form and colour, than any English *Unio* I have ever seen.

### 3. Unio *Retz.* (Union.)

Shell oblong-elongate; hinge with a short, crested, irregular anterior, and an elongated, laminar posterior, lateral tooth in the right valve, shutting between two similar teeth in the other valve.

Lives in slow rivers and streams.

These shells are liable to distortion about the hinge; the margin becomes thinner and extended; the shell truncated in front, the lunule enlarged and irregular, and the teeth nearly obliterated, which gives a wedge-shaped appearance to the shell.

a. *Anterior teeth compressed, elevated, sometimes crested.*

129. 1. UNIO *pictorum.* Thin Painters' Union.—Shell oval-oblong, ventricose, produced into a bluntly truncated beak behind, yellowish green, brownish zoned, greenish behind; upper edge nearly straight, lower rather retuse; hinge teeth very much compressed, arched, crenated; hinder teeth of left valve small or evanescent. (t. 2. f. 11.)

Young shell with a few isolated conical tubercles on the umbo. (*Pfeiffer*, ii. t. 2. f. 24.)

Mya pictorum. *Linn. S. Nat.?*; *Sturm*, *Fauna*, vi. 2. f. *a.*; *Wood*, *Conch.* 104. t. 19. f. 3, 4. *Schroet. Flussc.* t. 4. f. 6.—Unio pictorum. *Lam. Hist.* vi. 77.; *Ency. Méth.* t. 248. f. 4.; *Drap. Moll.* t. 11. f. 4.; *Rossm. Icon.* t. 3. f. 71. *a. b.*; *Pfeiffer*, i. t. 5. f. 9, 10.; *Leach*, *Syn. Moll.* 32. *a.*; *Forbes and Hanley*, *B. M.* ii. 142. t. 39. f. 1., t. 2. f. 2.—Unio rostratus. *Pfeiffer*, i. 114. t. 5. f. 8.; *Alder*, *Mag. Nat. Hist.* ii.—Mysca pictorum. *Turton Bivalves*, 245., *Man.* ed. 1. f. 11.—Unio elongatula. *Pfeiffer*, ii. 35. t. 8. f. 5, 6.—Unio limosus. *Nilson*, *Moll. Suec.* 110.—U. Deshayesii. *Mich. Comp.* 107. t. 16. f. 30.—U. ponderosus. *Rossm. Icon.* xii. 31. f. 767.—U. longirostris. *Rossm. Icon.* xi. 13. f. 738.—U. Philippi. *Dup. Cat.* 209., *Hist. M. F.* t. 28. f. 19.—U. curvirostris. *Normand.*; *Ross. Icon.* f. 200.—Mya ovalis. *Donn*, *B. S.* iv. 89.

The old shell becomes much thicker; and some of the varieties, as that called *U. Philippi*, almost form a passage to *U. tumidus.*

b. *Anterior teeth conical, high.*

130. 2. UNIO *tumidus.* Tumid Union.—Shell ovate elongate, wedge-shaped, tumid, produced and attenuated behind, thick, brown; lower edge

curved; umbones prominent, rugose; anterior teeth thick, high, triangular, strong; left hinder strong. (t. 2. f. 13.)

Young shell with irregular, concentric, nodulose ridges round the umbones. (*Pfeiffer*, ii. t. 2. f. 25.)

Unio tumidus. *Retzius*, *Nov. Gen.* 17. n. 3.; *Forbes and Hanley*, *B. M.* ii. 140. t. 40. f. 1.—U. rostrata. *Studer*, *Verz.* 23. — Unio tumida. *Pfeiffer*, ii. 34. t. 7. f. 2, 3., and t. 8. f. 1, 2.; *Rossm. Icon.* i. 117. t. 3. f. 70. *a. b.*, ii. 27., and t. 14. f. 202, 203, 204. — Mya ovalis. *Pulteney*, *Dorset.* 27. —Unio ovalis. *Leach*, *Syn. Moll.* 344.; *Flem. B. A.* 416.— Mysca solida. *Turton*, *Bivalves*, 246. t. 16. f. 2., *Man.* ed. 1. 22. f. 13.—Mya ovata. *Donovan*, iv. t. 122.—Unio inflata. *Hec. Moll. Valenc.* i. 148. — U. Michaudiana. *Des Moul. Act. Soc. Bourd.* vi. 20.—U. arcuata. *Bouch. Moll. Pays de Cal.* 91.

Inhab. slow rivers. New River, near London, West India Docks, &c.

Known from *Unio pictorum* by being much more solid, having larger and stronger anterior teeth, and by its tapering behind.

Mrs. Corrie has very kindly sent me some specimens with pale salmon-coloured pearly insides, which were found in a pond in Warwickshire.

According to M. Moquin Tandon, this animal in July and August emits small elongated pointed masses consisting of about 100 eggs in each mass. A single *Unio* will deposit 50 of these masses in two or three days. *Moll. France*, ii. 578.

The Abbé Dupuy divides what he considers the French species of *Unio* into three sections, thus:—

*a. Ponderosi.* — Shell very thick, heavy; cardinal and laminar teeth very thick; muscular scars deep.

β. *Batavi.* — Shell less thick than the preceding; the cardinal teeth oblique, less thick, sometimes conic; hinder teeth generally thick, elevated, but slightly elongate.

γ. *Rostrati.*—Hinge teeth generally thin and elongate; the hinder side of the shell ending in an oblique more or less acute beak.

I believe the first and last of these groups agree with the two British species, and that the presumed species are only varieties.

# APPENDIX.

## I.

### ARTIFICIAL TABLE.

This Artificial Table is merely intended to assist the student in the discovery of the genera, without any reference to their natural relations. The numbers refer to the pages in the body of the work.

### I. UNIVALVES.

Shells consisting of a more or less conical valve.

A. *Shell flat, solid.*

Limax. Shell oval or oblong, without any visible spire.—p. 75.

B. *Shell conical.*

Ancylus. Shell conical, apex recurved rather to the right.—p. 216.

Velletia. Shell conical, compressed, apex subcentral, bent to the left. — p. 220.

C. *Shell ear-shaped, solid.*

Testacella. — p. 53.

D. *Shell conical, spiral.*

a. *Shell thin, edge of lips not thickened or reflexed, peristome not continued.*

* *Mouth transverse, lunate; shell depressed.*

Vitrina. Shell imperforated; mouth large. — p. 85.

Zonites. Shell perforated, or umbilicated; mouth moderate. — p. 89.

(Helices, Pupa, Clausilia, &c., *when young.*)

** *Mouth longitudinal, dextral.*

† *Pillar-lip smooth, not folded.*

Succinea. Shell oval, amber-coloured; mouth large; front entire, rounded. — p. 147.

Bulimus (acutus). Shell turreted, white, variegated; mouth moderate; front entire, rounded. — p. 149.

Achatina. Shell turreted, white; mouth moderate; front truncated. — p. 158.

†† *Pillar with an oblique fold.*

Limnæus. Shell ovate or subturreted, perforated; inner lip not expanded. — p. 199.

Amphipeplea. Shell ovate, very thin, imperforated; inner lip rather expanded. — p. 212.

*** *Mouth longitudinal, sinistral.*

† *Pillar-lip smooth; shell very thin, imperforated.*

Physa. Shell ovate; inner lip rather expanded. — p. 224.

Aplexus. Shell turreted; inner lip not expanded. — p. 228.

†† *Pillar-lip with an oblique fold.*

Limnæus pereger lineatus. A monstrosity. — p. 199.

b. *Shell moderately thick; peristome not thickened, continued.*

* *Shell grooved, variegated, ovate; mouth suborbicular.*

Cyclostoma. — p. 18.

** *Shell smooth, olive; mouth ovate or orbicular.*

Valvata. Shell conical or depressed, umbilicated; mouth orbicular. — p. 34.

Paludina. Shell ovate, conical, perforated, olive, banded; mouth ovate. — p. 29.

Bithinia. Shell ovate, conical, perforated, transparent; mouth ovate. — p. 25.

Assiminia. Shell ovate, conical, solid, brown; mouth ovate. — p. 21.

Acicula. Shell subcylindrical, blunt, solid, brown; mouth ovate. — p. 39.

*** *Shell smooth, half-ovate; mouth half-circular; inner lip transverse, acute.*

Neritina. — p. 43.

c. *Shell moderately thick; edge of lips more or less thickened and reflexed.*

* *Mouth transverse.*

Helix. Shell suborbicular or conical; mouth lunate, or ovate or circular. — p. 100.

** *Mouth oblong, longitudinal.*

Bulimus. Shell oblong, striated; mouth toothless. — p. 145.

Zua. Shell oblong, polished; mouth margined, toothless. — — p. 154.

Azeca. Shell oblong, polished; mouth margined, toothed. — p. 156.

Carychium. Shell oblong, smooth, white; mantle oblong, margined, sinuous. — p. 190.

Conovulus. Shell oblong, smooth; mantle narrow; pillar obliquely plaited. — p. 191.

Pupa. Shell subcylindrical, striated, blunt; mouth margined, mostly toothed. — p. 160.

Vertigo. Shell subcylindrical, striated, blunt; mouth dextral or sinistral, margined, mostly toothed.— p. 167.

Balea. Shell turreted, striated; apex acute; mouth sinistral, not plaited. — p. 175.

Clausilia. Shell fusiform, striated; apex acute; mouth sinistral, plaited. — p. 177.

E. *Shell discoidal; whorls revolving nearly on the same line.*

* *Mouth lunate, sinistral, edge not continued.*

Planorbis. Cavity simple. — p. 230.

Segmentina. Cavity crossed with transverse ridges. — p. 245.

** *Mouth circular, dextral, edge continued.*

Valvata. — p. 34.

### II. BIVALVES.

Shell formed of two valves, connected together by a ligament on the dorsal edge.

* *Shell with diverging hinge-teeth; inside not pearly.*

Cyclas. Shell oblong, nearly equilateral. — p. 252.

Pisidium. Shell ovate, inequilateral. — p. 264.

** *Shell with irregular hinge-teeth; inside pearly.*

Unio. Shell with distinct posterior lateral laminar teeth. — p. 278.

Alasmodon. Shell without any lateral teeth. — p. 276.

*** *Hinge toothless.*

Anodon. Shell ovate, pearly; umbones (dorsal) blunt.—p. 271.

Dreissena. Shell triangular, not pearly; umbones (anterior) acute. — p. 259.

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## II.

AN OUTLINE OF THE HISTORY OF THE VARIOUS ADDITIONS WHICH HAVE BEEN MADE FROM TIME TO TIME TO THIS PART OF OUR FAUNA.

1st. Merret, who in 1667 published the first attempt at a British Fauna, in his *Pinax*, has recorded six species:—

1. Anodon cygneus (*Mytilus*, or Horse Muscle). — 2. Limneus (*L. stagnalis?*). *List. Ang.* t. 2. f. 1. — 3. Limax maximus. — 4. Helix Pomatia, which he says is found in Sussex. — 5. Helix rufescens (*Cochlea alba minor ubique in hortis*). — 6. Helix nemoralis (*Cochlea vulgaris testa variegata*). *List. Ang.* t. 2. f. 3.

2nd. Dr. Lister, in 1678, commenced a separate work on the British shells and, as was to be expected from his accuracy and the extent of his researches, he may be considered as the originator of this part of the science. He described and figured in this work, and in his larger work on conchology (where he marked the British species with an A), the following species,

and has besides given a good account of their animals; he gave, in the appendix to his larger work, the dissections of many of them:—

1. Neritina fluviatilis. *Ang.* t. 2. f. 20.; *Conch.* t. 141. f. 38., t. 607. f. 43, 44.—2. Paludina achatina. *Ang.* t. 2. f. 18.; *Conch.* t. 126. f. 26.—3. Paludina vivipara. *Conch.* t. 1055. f. 6., and *Anat.* t. 6. f. 5.—4. Bithinia impura. *Ang.* t. 2. f. 19. c., t. 132. f. 32.—5. Arion ater. *Ang.* t. 2. f. 17.; *Conch.* t. 101. f. 102, 103.—6. Limax flavus. *Conch.* t. 101. b. f. 1.—7. Limax agrestis. *Ang.* t. 2. f. 16.; *Conch.* t. 101. f. 101.—8. Helix hortensis. *Conch.* t. 57. f. 54.—9. Helix arbustorum. *Ang.* t. 2. f. 4.; *Conch.* 56. f. 53.—10. Helix lapicida. *Ang.* t. 2. f. 14.; *Conch.* t. 69. f. 68.—11. Helix aspersa. *Ang.* t. 2. f. 2.—12. Helix Cantiana. *Ang.* n. 12. var. p. 126.—13. Helix fulva. *Ang.* p. 123. n. 9.—14. Helix virgata. *Conch.* t. 59. f. 56.—15. Helix ericetorum. *Ang.* t. 2. f. 13. *Conch.* t. 78. f. 78.—16. Zonites radiatus. *Conch.* t. 1058. f. 11.—17. Succinea putris. *Ang.* t. 2. f. 24.; *Conch.* t. 123. f. 24.—18. Zua lubrica. *Ang.* t. 2. f. 7.—19. Bulimus acutus. *Conch.* t. 19. f. 14.—20. Pupa umbilicata. *Ang.* t. 2. f. 6.—21. Balea perversa. *Ang.* t. 2. f. 11.—22. Clausilia nigricans. *Ang.* t. 2. f. 12.—23. Clausilia bidens. *Conch.* t. 41. f. 39.—24. Limnæus palustris. *Conch.* t. 124. f. 24.—25. Limnæus auricularis. *Ang.* t. 2. f. 23.—26. Limnæus pereger. *Ang.* t. 2. f. 22.—27. Ancylus fluviatilis. *Ang.* t. 2. f. 32.; *Conch.* t. 141. f. 39.—28. Physa fontinalis. *Ang.* t. 2. f. 25.; *Conch.* t. 134.—29. Planorbis marginatus. *Ang.* t. 2. f. 27.—30. Planorbis vortex. *Ang.* t. 2. f. 28.—31. Planorbis corneus. *Ang.* t. 2. f. 26.—32. Aplexus hypnorum. *List. Conch.* app. f. 5.; *Pet. Gaz.* t. 10. f. 8.—33. Cyclostoma elegans. *Ang.* t. 2. f. 5.—34. Unio pictorum. *Ang.* t. 2. f. 30.—35. Unio tumidus. *Ang.* app. f. 6.—36. Alasmodon elongatus. *Ang.* app. t. 1. f. 1.—37. Cyclas rivicola. *Ang.* app. 22.; *Conch.* t. 159. f. 14.—38. Cyclas cornea. *Ang.* t. 2. f. 31.

3rd. Petiver, in his *Gazophylacium*, figured the following species, which had not been noticed by Lister:—

1. Valvata obtusa. *Gaz.* t. 18. f. 2.—2. Helix hispida *Gaz.* t. 93. f. 13.—3. Zonites nitens. *Gaz.* t. 93. f. 14.—

4. Planorbis contortus. *Gaz.* t. 92. f. 8.—5. Planorbis albus. *Gaz.* t. 92. f. 8.

4th. In 1777, Pennant, in his *British Zoology*, added—

1. Vitrina pellucida, noticed again by Captain Brown in 1818.—2. Helix Pisana, as H. zonaria.—3. Limnæus glaber.

5th. Boys, in 1784, in *Walker's Minute Shells*, added the following small species, which had before been overlooked :—

1. Valvata cristata, f. 18, 19.—2. Helix pulchella, f. 23.—3. Bulimus obscurus, f. 41.—4. Achatina acicula, f. 59, 60.—5. Carychium minimum, f. 51.—6. Acme fusca, f. 42.—7. Conovulus denticulatus, f. 50.—8. Planorbis imbricatus, f. 20, 21.—9. Segmentina lineata, f. 28.

6th. In 1786, Mr. Lightfoot, the botanist, in the *Philosophical Transactions*, added —

1. Helix pulchella, var. crenella, t. 3. f. 1. 4.—2. Helix aculeata, t. 2. f. 1. 5.—3. Planorbis nitidus, t. 2. f. 1. 4.—4. Velletia lacustris, t. 3. f. 1.

7th. Dr. Pulteney, in his catalogue of the Dorsetshire shells, adds —

1. Helix caperata.—2. Helix umbilicata.—3. Azeca tridens.—4. Planorbis spirorbis.

He added, however, to the list, at the same time, several exotic species.

8th. Dr. Maton and the Rev. Mr. Racket, in 1797, in the *Linnæan Transactions*, added —

1. Pisidium amnicum.

9th. Montagu, in 1803, in his excellent work on the *British Testacea*, added —

1. Helix fusca.—2. Helix granulata.—3. Bulimus montanus.—4. Pupa juniperi.—5. Vertigo substriata.—6. Vertigo angustior, as Turbo vertigo.—7. Clausilia biplicata.—8. Planorbis carinatus.—9. Limnæus truncatulus.—10. Conovulus bidentatus.—11. Conovulus albus.—12. Amphipeplea glutinosa.—13. Cyclas calyculata.—14. Unio ovatus.—15. Unio batavus.

10th. In June, 1819, Dr. Turton, in his *Conchological Dictionary*, added —

1. Pupa marginata.

11th. Baron Férussac, in 1820, in his *Concordance of the British Land and Fresh-water Mollusca*, first published as British, from specimens sent by Dr. Leach and Dr. Goodall, together with Testacella Maugei —

1. Helix Carthusiana. — 2. Clausilia Rolphii.

12th. In 1821, at the end of an outline of an arrangement of Mollusca, published in the *Medical Repository*, I added the following, among some others which had been neglected by British authors :—

1. Assiminia Grayana. — 2. Bithinia ventricosa.— 3. Arion hortensis. — 4. Zonites crystallinus. — 5. Zonites nitidulus.— 6. Zonites radiatulus. — 7. Zonites lucidus. — 8. Zonites pygmæus.

13th. In 1822, Dr. Turton, in his work on bivalves, added —

1. Pisidium pusillum.

14th. In the same year, Mr. Miller, in his *List of Shells about Bristol*, with three noticed in the former list, added —

1. Zonites alliarius.

15th. In the same year, M. Férussac, in his *Prodromus*, added —

1. Pupa anglica, sent him by Mr. Bean.

16th. In 1825, the Rev. Mr. Sheppard, in his *List of Suffolk Shells*, added —

1. Vertigo edentula. — 2. Planorbis carinatus, var. deformis. — 3. Pisidium Henslowianum.

17th. In 1826, Dr. Turton, in his Conchological Notices, in the *Zoological Journal*, added —

1. Cyclostoma simile *Drap.*, if not Bithinia ventricosa. — 2. Cyclostoma acutum *Drap.* — 3. Limnæus scaturiginum, which appears to be Lim. stagnalis junior,— all shells which it is impossible to determine; and with them he introduced the foreign Bulimus decollatus.

18th. In 1829, Mr. Jeffreys, in his paper in the *Linnæan Transactions*, added —

1. Succinea oblonga. — 2. Helix concinna. — 3. Helix lamellata, from Mr. Bean. — 4. Vertigo cylindrica. — 5. Vertigo pygmæa; 6. Vertigo palustris, both from specimens collected by me and presented to the British Museum. — 7. Vertigo pusilla.

19th. In 1830, Mr. Alder, in his *List of Newcastle Shells*, added —

1. Succinea Pfeifferi, distinguished as a variety by Jeffreys. — 2. Zonites purus. — 3. Zonites excavatus.

20th. In 1831, Captain Brown, in the *Edinburgh Journal of Geographical Science*, added —

1. Pisidium obtusale. — 2. Pisidium pulchellum.

21st. In 1831, Dr. Turton, in his *Manual*, added —

5. Limax Sowerbyi, from Dr. Leach's work.

22nd. In 1831, Mr. Lindsay, in the *Linn. Trans.*, added —

1. Helix obvoluta.

23rd. In 1832, Mr. Jenyns, in his *Monograph on Cyclas and Pisidium*, added —

1. Pisidium nitidum.

24th. In 1834, Mr. Thompson, in a notice read at the Linnæan Society, added —

1. Amphipeplea involuta.

25th. In 1837, Mr. Alder, in his *List of British Land and Fresh-water Shells*, added —

4. Helix hybrida, as a variety of H. hortensis. — 5. Helix depilata. — 6. Helix limbata, on the authority of Mr. G. B. Sowerby.

26th. In 1838, Mr. Alder, in a supplement to his paper on the Newcastle shells, added —

7. Helix sericea. — 8. Vertigo alpestris. — 9. Clausilia dubia. — 10. Planorbis lævis. — 11. Pisidium cinereum.

27th. In 1838, Mr. Gilbertson, at the meeting of the British Association at Newcastle, added —

1. Alasmodon elongatus, var. Roissyi.

28th. In 1839, Mr. Edward Forbes and Mr. Goodsir gave me, for the Museum collection, from Guernsey —

1. Helix aperta. — 2. Helix revelata.

29th. Mr. Bellamy, at the meeting of the British Association (in 1841) at Plymouth, showed specimens of Helix revelata, discovered near Mevagissey, Cornwall.

30th. Mr. Alder, in the *Annals and Magazine of Natural History* for 1846, describes a new Scotch shell, Limnea Burnetti.

31st. In 1856, Dr. Gray, in the *Annal. and Mag. Nat. Hist.* xvii. 466., and xviii. 25., describes two new British species of Sphærium, found near London —

1. Sphærium pallidum. — 2. Sphærium pisidioides.

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## III.

### LIST OF SPECIES IMPROPERLY INSERTED IN THE BRITISH FAUNA.

Wishing to make the work really what its title represents it, the species described are restricted to those which appear to be truly native. Only the two following, viz.

*Testacella haliotoidea*, t. 3. f. 19., and
*Dreissena polymorpha*,

have been admitted among those which are supposed to have been introduced in modern times. These have been admitted, because they are completely naturalised, and propagate themselves in our climate in the open air. Indeed it is doubtful whether the first of them may not be as strictly native as several other species commonly considered so; such as, *Helix pomatia*, *H. holosericea*, *H. carthusiana*, and *H. pisana*.

Several other species were recorded and described in the first edition of this work, which have been introduced with foreign plants, either buried in the mould or on the plants themselves, or which have most probably been brought to this country in the egg state. These are not truly acclimatised, and only propagate their species when they are kept in stoves

or hot-houses; they can therefore have no pretension to be considered as natives: among them must be recorded *, —

1. Testacella Maugei, t. 3. f. 18. A native of Teneriffe.

First noticed as having been introduced into this Fauna by Férussac, and then by Miller of Bristol.

2. Bulimus decollatus, t. 6. f. 3. A native of France.

3. Bulimus Goodallii, t. 6. f. 61.—Bulimus clavulus. *Turton, Man.* ed. 1. 79. f. 61. Inhab. Guadaloupe; naturalised in Bourbon and England.

To these may be added —

4. Helix maculosa. *Born. Mus.* t. 14. f. 15, 16. A native of Northern Africa, Egypt.

5. Bulimus zebra. Inhab. S. America, Honduras.

Is brought with the mahogany logs, and often lives for some time in this country.

6. Bulimus rosaceus. *King, Zool. Journ.* v. 341. Inhab. S. America, Chili.

7. Bulimus oblongus. *Brug.* Inhab. S. America.

8. Achatina bicarinata. *Lam. Hist.* vi. A native of the Cape of Good Hope.

For the same reason no notice is taken in the body of the work of the following species, which have been included among the British by one or more preceding authors, on what I am inclined to regard as insufficient authority.

Several of these have doubtless been introduced, by mistake for some other nearly allied British species; and others have been described from specimens which have been accidentally intermixed with British shells in the cabinets of careless collectors; but it is also to be feared that some have been wilfully palmed upon us by unprincipled persons, who wished to gain credit for their discovery, and to enrich their cabinets with foreign species, for which they, at the same time, coined British habitats, sometimes not even consistent with their proper station. It is curious that the persons who have been most addicted to

* The numbers immediately after the specific names refer to the plates of this work.

such practices often overreached themselves; for not satisfied with adding to the Fauna species which, from their geographical distribution, might possibly be found in our island, they often fixed on such tropical shells as were most easy of access, without heeding that these must at once be excluded from our Fauna when their true locality became known.

Some of the species introduced, as I believe, by mistake, are natives of the Continent, especially of the south of Europe. Such are —

1. Vitrina elongata. *Drap. Moll.* 120. Inhab. France.

2. Helicophanta brevipes. *Fer.* A native of the south of Europe.

3. Helix aperta, t. 11. f. 129. A native of the south of France, Bordeaux.

A single specimen is said to have been found in Guernsey, by Mr. Edward Forbes, but it has never occurred again.

4. Helix elegans. *Gmelin.* 3642. A native of Italy and the south of France.

5. Helix explanata. *Müller*, *Verm.* ii. 26. Inhab. Italy and the south of France, on the shores of the Mediterranean.

6. Helix conspurcata. *Drap. H. M.* 105. t. 7. f. 23. 25. A native of France and Sweden.

7. Helix Olivieri. *Férussac*, *Prod.* 255. Inhab. south of Europe, Syria (?).

8. Helix candidula *Studer. Rossm. Icon.* t. 26. f. 350. 353. Inhab. France, Germany, and Switzerland.

9. Helix sylvatica. (*fig.* 67.) *Drap.* t. 6. f. 1. Inhabits south of France near Lyons and Switzerland.

10. Helix lucorum. *Linn. S. N.* 1247. A native of Italy and the Levant.

*Fig.* 67.

11. Helix cæspitum. *Drap.* 109. t. 6. f. 14, 15. A native of the south of France, Spain, and Syria.

12. Helix limbata, t. 11. f. 132. *Drap. Moll.* 190. t. 6. f. 29. A native of the south of France.

A few living specimens were set free on the New North

Road, near Hampstead, by Mr. G. B. Sowerby; but they did not propagate themselves.

13. Helix neglecta. *Drap.* 108. t. 6. f. 12, 13. A native of the south of France, Italy, and Syria.

14. Helix plebeia. *Drap.* A native of France, Switzerland, and Germany.

15. Bulimus detritus. (*fig.* 68.) *Deshayes. Drap.* t. 4. f. 21. *Rossm. Icon.* t. 2. f. 42. Inhab. France and Germany.

Fig. 68.

16. Bulimus ventricosus. *Drap.* 78. t. 4. f. 31, 32. A native of the south of France, Italy, Syria, and Spain.

17. Bulimus pupa, t. 6. f. 64. *Brug. E. M.* 349.; *Rossm. Icon.* t. 28. f. 379. Inhab. Sicily, Italy, and North Africa.

18. Pupa cinerea. *Drap.* 65. t. 3. f. 53, 54. Inhab. south of France, Italy, Switzerland, and South Germany.

19. Pupa tridens. *Drap.* 68. t. 3. f. 57. Inhab. the continent of Europe.

20. Pupa obtusa. *Drap.* 63. t. 3. f. 44. A native of France and the Alps.

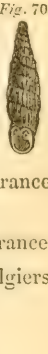
Fig. 69.

21. Clausilia labiata. (*fig.* 69.) *Turton, Man.* ed. 1. f. 57. Inhab. France (?), Malta.

22. Clausilia papillaris. *Drap.* t. 4. f. 13. Inhab. Sicily.

23. Clausilia ventricosa. (*fig.* 70.) *Drap.* t. 3. f. 14. Inhab. France.

Fig. 70.



24. Achatina folliculus, t. 9. f. 104. *Lam.* vi.; *Michaud, Compl.* 53. t. 15. f. 14, 15. Inhab. south of France, Sicily, under stones, &c.

25. Diastropha contorta, t. 9. f. 111. Inhab. Sicily, Corsica, Algiers, and the Pyrenees.

26. Physa acuta. *Drap.* 55. t. 3. f. 10, 11. Inhab. France, Italy, and Sicily.

27. Planorbis lutescens. *Lam. Hist.* vi. 153. Inhab. France.

28. Cyclostoma ferrugineum. *Lam.* Inhab. Minorca, Algiers.

29. Cyclostoma sulcatum. *Drap.* 33. t. 13. f. 1. Inhab. Provence, South Italy, and Sicily.

30. Valvata minuta. *Drap.* 12. t. 1. f. 36, 37, 38. Inhab. France.

31. Valvata spirorbis. *Drap.* 41. t. 1. f. 32, 33. Inhab. France.

32. Unio Batava, t. 2. f. 10.

33. Unio ovalis, t. 2. f. 12.

34. Cyclas lacustris. *Drap.* 130. t. 10. f. 6, 7.; *Turton, Man.* ed. 1. 14. t. 1. f. 4. Inhab. France.

The following introduced species are only found in tropical climates:—

1. Achatina octona, t. 6. f. 72. Inhab. the West Indies, St. Vincent's. (Dr. Turton.)

2. Bulimus exilis, t. 9. f. 109. Inhab. West Indies, St. Vincent's. (Rev. L. Guilding.)

3. Bulimus fragilis. *Lam. Hist.* vi. ed. 2. 231. Inhab. Brazil.

4. Bulimulus fuscus. *Guilding, Zool. Journ.* iv. 176. Inhab. West Indies, St. Vincent's. (Rev. L. Guilding.)

5. Bulimus cylindrus. *Gray, Ann. Phil.* 14. f. 68. Inhab. West Indies, Island of Tortula. (Rev. L. Guilding.)

6. Conovulus coffee.

In Montagu's collection in the British Museum, mixed with *Voluta bullæoides.*

7. Detracia bullæoides. *Gray.* Inhab. West Indies, St. Vincent's. (Guilding.)

8. Tralia pusilla. *Gray.* — Voluta triplicata. *Donovan, B. S.* t. 138. Inhab. West Indies.

9. Aplexus rivalis, t. 9. f. 112. *Maton and Racket, L. Trans.* xiii. 126. t. 4. f. 2. Inhab. West Indies, St. Vincent's. (Rev. L. Guilding.)

10. Neritina virginea. (*fig.* 71.) *Lamarck,* n. 18. Inhab. West Indies and N. America.

11. Truncatella subcylindrica. (*fig.* 72.) Inhab. West Indies.

*Fig.* 71. *Fig.* 72.

12. Melania Matonii. *Gray, Linn. Trans.* vii. 150. t. 4. f. 6. An African river shell.

Thus have I felt myself called on to exclude from our Fauna no fewer than 54 species.

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## IV.

### GEOGRAPHICAL DISTRIBUTION.

In considering the *geographical distribution* of the British land and fresh-water Mollusca, we must look at them at least in two points of view: first, as regards their bearing on the general distribution of Mollusca in the rest of Europe; and secondly, the extent to which the various species are diffused over the different parts of the island, which is influenced by the climate, the elevation, and the nature of the subsoil, or of the rock of which the country is chiefly formed.

All the species which appear to be really native, and are therefore noticed in this work, are found in France, or in different parts of Germany, except the following:—

1. *Assiminia Grayana.* — 2. *Vertigo angustior.* — 3. *Amphipeplea involuta.*—4. *Cyclas pallida.*—5. *C. pisidioides.*

These are newly described species, and may have been overlooked, or only considered as varieties of other well-known species, by the zoologists of the Continent. It is to be remarked that, in general, the British species, although they vary among themselves, attain a moderate and nearly uniform size, compared with those of the rest of Europe. Thus I have never seen *Lymneus stagnalis*, *Paludina achatina* or *crystallina*, so large as those found in the south-eastern part of Germany; or *Helix nemoralis*, and other more common *Helices*, as those found in Portugal, or the *Helix aspersa* from Algiers; nor, on the other hand, have I seen any English specimens of *Helices* so stunted in growth as the Alpine varieties of *H. nemoralis* and *H. arbustorum*, which I have received from the Swiss Alps.

Férussac has observed (*Journ. de Phys.* 1820) that it is re-

markable that in our more northern latitudes, as compared with France, there are found in abundance some species, such as *Helix pisana* and *Bulimus acutus*, which for their size and colour are only to be compared to the French specimens found on the banks of the Loire.

On the other hand, there are many species, not found in our catalogues, that are common to nearly all the rest of Europe.

Thus, according to Nilson, 73 of our British species are found in Sweden, and many of them, as, for example,

*Helix pygmea*, *Helix fulva*, *Helix rotundata*, *Helix pulchella*, *Zua lubrica*,

at its most northern extremity; and he has, in his Fauna, 16 species which have not yet been found in Britain or Ireland: viz.

*Limax tenellus*; *Helix bidentata* Nilson, not Gmelin; * *Helix fruticum*; **Helix strigella*; **Helix incarnata*; **Helix conspurcata*; **Helix ericetorum* Nilson, not Linn.; *H. candidula* Studer; *Clausilia papillaris*, if it is not our *C. biplicata*; **Pupa costulata*; *Paludina balthica*, if not our *Littorina ulvæ*; *Paludina octona*; **Paludina similis*; *Cyclas lacustris*; *Unio ater*; **Unio crassus* Nilson; *U. littoralis*, Lam.; *Unio limosus*.

And of these at least half (those marked with a star) are also common to France and to Germany; and this may be the case with some of the others. Some of these species (of *Helix*, for example) are of a size as large as *H. hortensis* and *H. rufescens*; and the largest, as *H. fruticum*, *H. strigella*, and *H. candidula*, are found as far south as Vienna, and *H. incarnata* as far as Italy. Indeed, some of the Continental conchologists appear to upbraid our idleness in not having found them in England, where, probably overlooking our insular position, they assume that these species ought to be found.

Nearly three fourths of our species, that is to say 91 out of the 126, are recorded by Pfeiffer as inhabiting Germany; and the Germans have 80 species which are wanting to our Fauna; but it is remarkable that they have not some of our larger species, as —

*Limax Sowerbii*, *Helix fusca*, *Helix pisana*, *Helix granulata*, *Amphipeplea glutinosa*, *Segmentina lineata*.

They also want some of our smaller ones, as —

*Zonites purus*, *Zonites radiatulus*, *Zonites excavatus*, *Pupa umbilicata* (?), *Pupa anglica*, *Vertigo alpestris*, *Vertigo angustior*, *Vertigo palustris*, *Planorbis lævis*, and two or three *Pisidia*.

On the other hand, many of the British shells find their southern limits in France and Germany; for only 22 of them are found in Sicily, and only 17 in Corsica. Of these southern species, the greater part, viz. the 18 following, are common to those countries, Britain, and Sweden: viz. —

*Paludina vivipara*, *Paludina crystallina*, *Bithinia impura*, *Succinea putris*, *Helix nemoralis*, *Helix pulchella*, *Helix ericetorum*, *Zonites radiatus*, *Zonites cellarius*, *Achatina acicula*, *Clausilia Rolphii* (?), *Clausilia rugosa*, *Limnæus pereger*, *Limnæus stagnalis*, *Limnæus palustris*, *Limnæus fossarius*, *Limnæus glaber*, *Anodon cygneus*.

There are only a very few species of the British land and fresh-water Mollusca which appear to be common to the American continent.

According to Férussac, *Helix pulchella* is the *H. minuta* of Say.

*Zonites nitidus* is probably the *H. arborea* of Say.

Say considered the *Paludina vivipara* of the two countries the same species.

Mr. Lea considers, I believe truly, that the *Unio margaritifera* of the two countries is the same species.

From the facility with which the land Mollusca can be transported during their torpidity, there have been introduced into Canada and the United States the following British species:—

*Helix nemoralis*, Canada and U. States; *Helix hortensis*, Boston; *Helix aspersa*, U. States; *Helix virgata*, U. States (Férus.); *Helix pisana*, U. States (Férus.); *Bulimus acutus*, U. States (Lesueur).

*Bulimus decollatus* has been introduced into gardens near Charlestown, S. Carolina. One of the species, *H. aspersa*, has also been introduced and naturalised in Brazil and some places in South America.

The facility with which these animals migrate and adopt a new country, as proved by the above instances, by those cited at p. 291., and by the naturalisation of the *H. cantiana* (130.) on the banks of the Tyne, will always make the study of the geographical distribution of the terrestrial Mollusca difficult. According to the accounts of the American authors, the species which have naturalised themselves retain their fondness for trees and hedges and herbage, and keep themselves quite distinct from the forest-living species of America.

There are one or two species whose distribution appears more to depend on the nature of the country than the climate. Thus, the *Alasmodon elongatus* is found in the mountain streams of Wales, Cumberland, Scotland, and Ireland, and the variety *A. e. Roissyi* is found in similar situations in Yorkshire and Scotland.

In Irish lakes there has been found by Mr. Harvey *Amphipeplea involuta*, which is very different from the English ones. It is to be hoped that this is only a forerunner of several other species which will hereafter be found in that very interesting and but little investigated country.

It is probable that many of the species may have a much more extended range than is generally believed; for had this sketch been written a very few years ago, many of the species, such as *Helix fusca*, *H. depilata*, *Bulimus montana*, *Azeca tridens*, *Pupa edentula*, *Acme fusca*, *Limnæus glaber*, *Amphipeplea glutinosa*, would have been inserted in the list of local species. The latter, though found in Sweden and France, is not recorded as a German species by Pfeiffer. Though very local where found, these and other species similarly circumstanced have been met with, dispersedly, in widely different parts of the islands.

Besides fewer species being found in the northern parts of our island than in the south, the specimens of the species are said to be much more rare. This is partly owing to the rigours of the climate, and partly to the country consisting of the older geological formations, which are less favourable to the support of these animals than the calcareous rock, which appears to be their favourite habitation.

M. D'Orbigny, who has paid great attention to the distribu-

tion of these animals, especially in South America, says the terrestrial Pulmonobranchiata are much more abundant in the warmer regions of the different quarters of the globe than in the more temperate parts, while the aquatic species are more abundant in the latter than in the former.

He observes that the terrestrial species gradually diminish in number as we proceed from the warmer regions towards the pole; and as we ascend from the plains to the tops of mountains. Out of the 156 species which he found in South America, 137 were found between the 11th and 28th, 28 between the 28th and 34th, and only 13 between the 34th and 45th degrees of south latitude; and 126 species were found under 5000 feet, while only 4 were found above 5000 feet and below 11,000 feet, and 6 at more than 11,000 feet above the level of the sea.

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## V.

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Description of a New Helix. *l. c.* iv. (1842) 241.

Two New Helices. *l. c.* iv. (1842) 360.

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# EXPLANATION OF THE PLATES.

(*The species in italics are foreign.*)

## Table I.

Fig.
1. Cyclas rivicola.
2. cornea.
3. lacustris.
4. *lacustris*, Drap. cop.
5. Pisidium amnicum.
6. Henslowianum.
7. pusillum.
8. Anodon cygneus.

## Table II.

9. Alasmodon margaritiferus.
10. Unio *Batavus*.
11. pictorum.
12. *ovalis*.
13. tumidus.

## Table III.

14. Limax maximus.
15. carinatus.
16. flavus.
17. agrestis.
18. *Testacellus Maugei*.
19. *haliotoideus*, var. scutulum.
20. *haliotoideus*.
21. Vitrina pellucida.
22. Helix rufescens.
23. nemoralis.
24. hortensis.
25. arbustorum.
26. cantiana.
27. carthusiana.

Fig.
27*. Helix. See Tab. XI.
28. rufescens.
28*. See Tab. XI.
29. granulata.

## Table IV.

30. Helix Pisana.
31. virgata.
32. fasciolata.
33. aculeata.
34. Pomatia.
35. aspersa.
36. fusca.
37. ericetorum.
38. Zonites lucidus.
39. alliarius.
40. cellarius.
41. Helix hispida.
42. Zonites crystallinus.
43. purus.

## Table V.

44. Zonites rotundatus.
45. umbilicatus.
46. pygmæus.
47. fulvus.
48. Helix lamellata.
49. pulchella.
50. *Helicophanta brevipes*, copied from Drap.
51. Helix lapicida.
52. Azeca tridens, and mouth magnified.

Fig.
53. Clausilia bidens, and mouth magnified.
54. Rolphii, and mouth magnified.
55. biplicata, and mouth magnified.
56. *papillaris*, and mouth magnified.
57. *labiata*, and mouth magnified.
58. nigricans, and mouth magnified.
59. nigricans, var. dubia.

Table VI.

60. *Bulimus decollatus.*
61. *Goodallii*, and magnified.
62. lackamensis.
63. hordeaceus.
64. *Pupa.*
65. Zua lubrica, and mouth magnified.
66. Acicula fusca, and magnified.
67. Bulimus acutus.
68. *cylindrus.*
69. *ventricosus.*
70. Balea perversa, and mouth magnified.
71. Achatina acicula, and magnified.
72. *octona.*
73. Succinea putris.
74. Pfeifferi.
74.* Pfeifferi, var.
139. oblonga.

Table VII.

75. Cyclostoma elegans.
76. *ferrugineum.*
77. Carychium minimum, and magnified.
78. Pupa umbilicata, shell and its mouth magnified.
Fig.
79. Pupa marginata, shell and its mouth magnified.
80. Vertigo edentula, shell and its mouth magnified.
81. Pupa juniperi, shell and its mouth magnified.
82. anglica, old and young shells and their mouths magnified.
83. Vertigo pygmæa, shell and its mouth magnified.
84. substriata, shell and its mouth magnified.
85. palustris, shell and its mouth magnified.
86. pusilla, shell and its mouth magnified.

Table VIII.

87. Planorbis marginatus.
88. var.
89. carinatus.
90. marginatus jun.
91. vortex.
91*. distorted and magnified.
92. carinatus, var. 1.
93. nitidus.
94. imbricatus.
95. corneus.
96. contortus.
97. albus.
98. spirorbis.
99. Segmentina lineata

Table IX.

100. Limnæus auricularius.
101. pereger.
101*. See Tab. XI.
102. *scaturiginum*, copied from Drap.
103. Amphipeplea glutinosa.

Fig.
104. Limnæus stagnalis.
105. var. 1.
106. glaber.
107. palustris.
108. truncatulus.
109. *Bulimus exilis.*
110. Physa fontinalis.
110*. See Tab. XI.
111. *Diastropha contorta.*
112. *Aplexus rivalis.*
113. hypnorum.

Table X.

114. Valvata piscinalis.
115. cristata.
116. var.
117. *minuta.*
118. Paludina vivipara, and operculum.
119. achatina.
120. Bithinia tentaculata, and operculum.
121. "Paludina similis."
122. " viridis."
123. " stagnorum."
124. Neritina fluviatilis.
125. Ancylus fluviatilis.
126. Velletia lacustris.
127. See Tab. XI.
128. Bithinia ventricosa.

Table XI.

27*. Helix carthusiana, var. thin.
28*. rufescens, var. albida.
101*a*. Limnæus pereger, var. lineatus, and reversed var.

Fig.
101*b*. Limnæus pereger, var. lacustris.
101*c*. pereger distorted.
101*d*. pereger, var. acutus.
110*. Physa fontinalis, var.
127. Assiminia Grayana, and magnified.
128. See Tab. X.
129. Helix aperta, with epiphragma.
130. hybrida.
131. obvoluta.
132. limbata.
133. revelata.
134. sericea.

Table XII.

135. Helix concinna.
135*. depilata.
136. Zonites nitidulus.
136*. Helmii.
137. radiatulus.
138. excavatus.
139. See Tab. VI.
140. Vertigo cylindrica.
141. alpestris.
142. (Not to be procured.)
143. Clausilia dubia, and mouth magnified.
144. Conovulus denticulatus.
145. bidens.
146. albus.
147. Amphipeplea involuta.
148. Planorbis lævis.
149. Pisidium obtusale.
150. nitidum.
151. pulchellum.
152. cinereum.

1. Cyclas rivicola.
2. C. cornea.
3. C. lacustris.
4. C. lacustris
5. Pisidium amnicum
6. P. Henslowianum
7. P. pusillum.
8. Anodon cygneus

9. Alasmodon *radiatiferus*
10. Unio *Batavus*
11. U. *pictorum*
12. U. *caudalis*.
13. U. *tumidus*

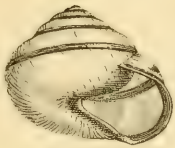
14.

17.

16.

15.

18.



23.

19.

20.

24.

21.

28*.

25.

28.

26.

29.

27.

1. Limax maximus.
2. L. carinatus.
3. [illegible]
4. [illegible]
5. *T[illegible]s Mauser.*
19. *T. haliotoideus.*
20. *T. h.*
21. Vitrina pellucida
22. Helix rufescens.
23. H[illegible]
26. H. arbustorum
26. H. Cant[illegible]
27. H[illegible]
28. H. rud[illegible]

44

45

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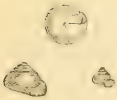

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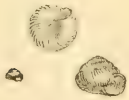

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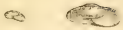


50

52 53 54 55

56 57 58 59

Helix rotundatus
H. umbilicatus.

49. H. pulchella
50. *Helicopi*
51. Helix l

C. Rolphii.

59. C. n. var. dubia

60
61
62. B. Lackame
63. B. hordeace
64. *B. Pupa*
65. Zua lubrica
66. Acme fusc
67. Bulim
68
69. *B*
70. Balea perver
71. Achatina acic

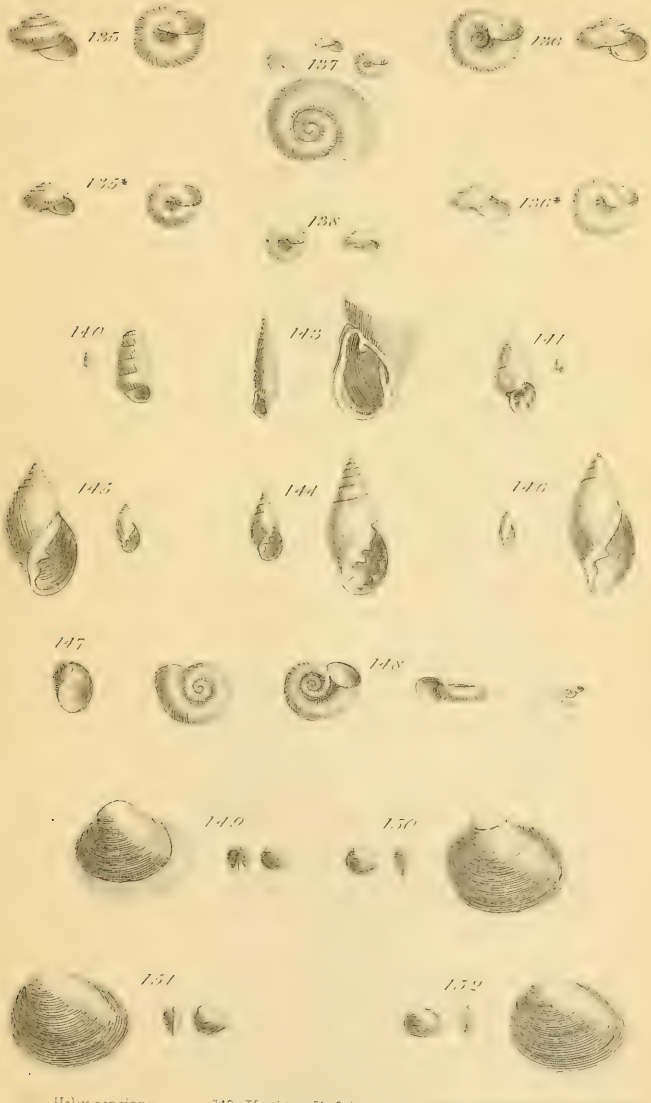
79 P. marginata. Vertigo pygmæa
80 Vertigo edentula V. substriata
81 Pupa juniperi V. palustris
82 P. anglica V. pusilla

91. P. vortex.
91* P. v. distorted.
92. P. carinatus var.
93. P. nitidus.
94. P. imbricatus
95. P. corneus
96. P. " "
97. P. albus
98. P. " "
99. Segmentina lineata

104. Limnæus stagnalis. 108. L. truncatulus
105. L. s. var 109. *Bulimus exilis*
106. L. glaber 110. Physa fontinalis
107. L. palustris. 111. *Diastropha* [illegible]
112. *Aplexus rivalis*. 113. A. hypnorum.

114 Valvata piscinalis.
115
116 V. c. var.
117 V. minuta
118. Paludina vivipara and operculum
119. P. achatina
120. Bithinia tentaculata and operculum
121. Paludina similis.
125 Ancylus fluviatilis
126. Velletia lacustris 128. Bithinia ventricosa.

7. Helix Carthusiana.
8. H. rufescens, var. albida.
9a. Limnæus peregr. var. lineatus and reversed var.
9b. L. p. var. lacustris.
10la L. p. distorted.
10lc L. p. var. acutus.
110+ Hysa fontinalis var.
127. Assiminia Grayana.
129. Helix aperta, with epiphragma.
130. H. hybrida.
131. H. obvoluta.
132. H. limbata.
133. H. revelata.
134. H. sericea.




Helix concinna.
135* H. depilata.
136. Zonites nitidulus.
136* Z. var. Helmii.
137. Z. radiatulus.
138. Z. excavatus.
140. Vertigo cylindrica.
141. V. alpestris.
143. Clausilia dubia.
144. Conovulus denticulatus.
145. C. bidens.
146. C. albus.
148. Planorbis lævis.
149. Pisidium obtusale.
150. P. nitidum.
151. P. pulchellum.
152. P. cinereum.

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